— Other Agricultural Chemical

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MERCURY RESIDUES IN WILDLIFE IN ALBERTA

A Report prepared by the

Alberta Interdepartmental Committee on

Pesticides

for the Minister,

Alberta Department of Agriculture,

Edmonton, Alberta.

January 19, 1970

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CONTENTS

1. INTRODUCTION

This report attempts to bring together all of the information that has been collected to date on the problem of mercury residues in wildlife, particularly upland game birds, in the province and at the same time shows what is being done to reduce this problem.

A chronological sequence of events dealing with this problem up to the present time is as follows:

Summer and Fall, 1968	- Canadian Wildlife Service samples wildlife for mercury residues.
June, 1969	- Results from Canadian Wildlife Service Survey showed high mercury levels in some birds and mammals including pheasants and Hungarian partridges.
June - July, 1969	- Further samples of pheasants and Hungarian partridges (26 birds total) collected for mercury analyses from southern Alberta.
September 8, 1969	- Results from these analyses showing high residues in the sampled birds sent to secretary, Alberta Interdepartmental Committee on Pesticides.
September 12, 1969	- Special meeting of Alberta Interdepartmental Committee on Pesticides called. Committee recommends closing of hunting season for pheasants and Hungarian partridges and requests Fish and Wildlife to collect more specimens for analysis. Working Subcommittee of A.I.C.P. organized to investigate problem.
September 18, 1969	- Opening of hunting season on pheasants and Hungarian partridges cancelled.
October 9, 1969	- Second special meeting of A.I.C.P. called. Insufficient data on further mercury analyses were ready and decision regarding cancellation of hunting season remained.

A. BACKGROUND

This report attempts to bring together all of the information that has been collected to date on the problem of mercury residues in wildlife, particularly upland game birds, in the province and at the same time shows what is being done to resolve this problem.

A chronological sequence of events dealing with this problem up to the present time is as follows:

Summer and Fall, 1968	- Canadian Wildlife Service samples wildlife for mercury residues.
June, 1969	- Results from Canadian Wildlife Service Survey showing high mercury levels in game birds and animals including pheasants and Hungarian partridges.
June - July, 1969	- Spring sampling of pheasants and Hungarian partridges (75 birds total) collected for mercury analysis from southern Alberta.
September 5, 1969	- Results from these analyses showing high residues in the sampled birds sent to secretary, Alberta Interdepartmental Committee on Pesticides.
September 12, 1969	- Special meeting of Alberta Interdepartmental Committee on Pesticides called. Committee recommends closing of hunting season for pheasants and Hungarian partridges and requests Fish and Wildlife to collect more specimens for analysis. Standing Subcommittee of A.I.C.P. organized to investigate problem.
September 19, 1969	- Opening of hunting season on pheasants and Hungarian partridges cancelled.
October 9, 1969	- Second special meeting of A.I.C.P. called. Insufficient data on further mercury analyses were ready and decision regarding cancellation of hunting season remained.

October 16, 1969 - Third special meeting of A.I.C.P. called but a decision on whether to open the hunting season on pheasants and Hungarian partridges could not be made because the results from the outside laboratories were not available.

October 28, 1969 - Hunting season on pheasants and Hungarian partridges closed because no new data available to support altering the original decision.

December 17, 1969 - Working Subcommittee reports to A.I.C.P. results of analyses done by Provincial analyst, Plant Products Laboratory in Calgary, University of Toronto, and Gulf Atomic Laboratory, California, and recommends procedure for continuing investigations.

This extreme simplification of the situation has been done to establish a frame of reference so that all the aspects of the problem can be better understood. A more full account of these events can be found in the rest of the report which can be briefly summarized.

Part 2 deals with the chemistry and toxicology of mercury compounds and the tolerances established by the World Health Organization and by the Food and Drug Directorate for mercury residues in food products. But more important, it presents the difficulties and costs involved in obtaining meaningful results from the various analytical methods used for detecting very small amounts of mercury in animal tissue.

Part 3 gives a history of the uses of mercury as a seed-treatment fungicide in this province and indicates that while new non-mercurial fungicides are being currently tested, measures are also being taken to encourage the proper handling of treated seed.

In contrast to the preceeding, the role of the Canadian Wildlife Service in the monitering of pesticides in wildlife is presented in Part 4. The discovery of high mercury residues in pheasants and Hungarian partridges collected in Alberta in 1968 and 1969 resulted in several special meetings of the A.I.C.P. and in the recommendation of this committee

to close the 1969 hunting season on these birds. A summary of the minutes of these special meetings is given in Part 5. A summary of the results of mercury analyses of game birds collected in September, 1969 and the distribution of these samples is given in Part 6 while Part 7 reports on the feeding trials currently being conducted on pheasants to determine the concentrations of mercury in tissues resulting from ingestion of known amounts of treated seed and the length of time these residues are likely to remain in the tissues of the experimental birds.

The results of about 120 analyses of the 382 birds collected in September, 1969 show a general decline in mercury levels compared with June-July samples but some still show levels that are above acceptable tolerances. A much better idea of the proportion of contaminated birds and of the areas where these birds were collected can only be obtained, however, after all the samples are analyzed.

The committee agrees that contaminated birds have probably fed on grain that is treated with mercury to prevent disease. Indeed, a preliminary investigation has shown that treated seeds have been dumped making them readily available to pheasants and other seed eating animals. There is also a possibility that treated seed spilled on highways and around farm yards as well as on the headlands of the fields is being eaten by wildlife. But the committee feels that for this year there probably will not be a repetition of the events of 1969 because of the extensive monitering of mercury residues that is planned and because it is assumed that farmers will take greater care in handling treated grain so as to reduce the chances of mercury-treated seed being eaten by wildlife. It is certainly hoped that if mercury residues do appear in game birds this year, the incidence will be very low so that human health will not be affected although the problem of contamination of wildlife will, of course, still be present.

2. MERCURY: CHEMICAL AND TOXICOLOGICAL ASPECTS

I. INTRODUCTION

Mercury is a dense silvery metal, which is liquid at normal temperatures; most individuals are familiarized with it at an early age, usually at school, because it is a curiosity as well as a very useful material, in the elemental form or in the form of various compounds. Mercury and its compounds differ widely in properties, and it is essential to distinguish between the different forms when considering their toxicology and hazard potential. A basic division into inorganic and organic compounds is generally accepted. The term "inorganic mercury" refers to elemental mercury and its vapor, mercurous (Hg_2^{2+}) and mercuric (Hg^{2+}) salts, and those complexes in which mercuric ions can form reversible chemical bonds to tissue ligands such as thiol (-SH) groups or proteins. Those compounds in which mercury is directly linked to a carbon atom by a covalent bond can be classified as organomercurial compounds and will generally be described as "organic mercury".

II. USES OF MERCURY IN ALBERTA

A most useful review on the uses of mercury in Canada has been prepared Fimreite[1]; this indicates that there has been a considerable rise in its use over the past ten years, and imports exceeded 1,000,000 lbs. in 1968. Prior to 1968 all mercury used in Canada was imported, but the re-opening of Cominco's Pinchy Lake mine (British Columbia) should result in great changes in the import-export pattern.

The major use of mercury compounds in Alberta is probably in the form of organic mercury fungicides for seed treatment and other agricultural or horticultural purposes. In 1968, some 10,830,000 bushels of cereal grain were treated with mercury compounds containing about 3.7 tons of mercury. The majority of seed treatment chemicals contain less than 3% by weight of mercury. A more detailed account of these uses appears elsewhere in this report. In the original formulations the organic mercury compounds are fairly volatile and are fairly readily dispersed in the environment to insignificant levels. However, organic mercury which has been used to treat

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(1) Fimreite, N. Mercury uses in Canada and their possible hazards as sources of mercury contamination. Department of Zoology, University of Western Ontario, March 1969.

cereal grains is fixed by the grain proteins and remains concentrated in the seed until such a time that the seed disintegrates and the proteins are degraded. One of the major difficulties in replacing organic mercury compounds as fungicides, is that alternative compounds, though very effective, are not able to resist the leaching and biochemical processes which take place between the time of planting and germination. A most useful review of the agricultural use of mercury compounds was prepared by Smart.[(2)]

Since there are no restrictions or checks on the general use of mercury and compounds in Alberta, it is impossible, at this time, to provide any factual information on the quantities used. The province is fortunate in that its one pulp mill does not use organic mercury as a slimicide and that its two chlorine plants do not use the mercury "chlor-alkali" process.

Elemental mercury, in quantities from a few ounces to many pounds, is widely used for the following purposes:

(a) in rectifiers, switchgear etc. for the electrical and electronics industries;

(b) in thermometers, gauges, gas analysis instruments, etc., in laboratories, schools, industry and at oil/gas drilling sites;

(c) in mercury diffusion pumps for high vacuum equipment, mainly in laboratories;

(d) as an alloying agent for the recovery of precious metals;

(e) as mercury amalgam in dental work;

(f) in mercury batteries for electronic equipment eg. in automatic cameras.

Depending on the means of handling and disposal, mercury from these sources is widely distributed throughout the environment as the metal, compounds, and vapor. Elemental mercury is generally considered to be insoluble in water, but under various acidic conditions and in the presence of certain compounds, oils and solvents, sufficient can dissolve to cause significant contamination.

Various mercury compounds, organic or inorganic are used in chemical laboratories as reagents, catalysts and for study, and as catalysts in certain industrial processes. Effluents from these establishments could be significantly contaminated with mercury.

[(2)] Smart, N.A. Use and residues of mercury compounds in agriculture. Residue Reviews 23, (1968), 1-36.

One industrial establishment, located in Calgary, manufactures organic mercury fungicides. The process is operated for only a relatively short period each year to meet the demand for these compounds; the precautionary measures taken during processing are of the highest order.

Minor uses of mercury compounds include their incorporation in pharmaceutical preparations (medical and veterinary), detonators and percussion caps (mercury fulminate), antifungal paints and a number of "silvering" processes.

III. TOXICOLOGY

The absorption, excretion and effects of mercury compounds vary with different biological species. The summary which is presented here is restricted to aspects that are relevant to human health. Additional and more comprehensive information may be obtained from a number of excellent reviews which have been published during the past few years.[3-7]

(a) Inorganic mercury

Absorption of elemental mercury into the system can take place by inhalation of the vapor, absorption through the skin or via the gastro-intestinal tract. If absorption is by the latter two routes it is necessary for the mercury to dissolve in the gastric juices or skin secretions before it can enter the blood stream. Mercury vapor is rapidly absorbed from the lungs into the blood, between 70% and 85% of the vapor inhaled being absorbed. Because elemental

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(3) Maximum allowable Concentrations of mercury compounds. Report of an International Committee. Arch. Environ. Health 19, (1969), 891-905.

(4) Brown, J.R. and Vulkarni, M.V. A review of the toxicity and metabolism of mercury and its compounds. Medical Services Journal (Canada) May 1967, 786-808.

(5) Bidstrup, P.L. Toxicity of mercury and its compounds. Elsevier Publishing Company, New York (1964).

(6) Swensson, A. and Ulfvarson, U. Toxicology of organic mercury compounds used as fumigants. Occupational Health Review (Canada) 15, (1963), No. 3, 5-11.

(7) Lofroth, G. Methyl mercury. Bulletin No. 4 Ecological Research Committee, Swedish Natural Research Council, Stockholm (1969).

mercury vaporizes so readily, inhalation is the most serious hazard for persons exposed to the metal. After inhalation of the vapor, mercury circulates in the blood partly unchanged and partly oxidized to mercuric ions. Elemental mercury in the blood diffuses into tissues and across cell membranes; it has a particular affinity for lipid (fatty) matter found in nerve and brain tissues. The mercury is then oxidized to the mercuric form after which it binds to thiol (-SH) groups and other ligands, which are ubiquitous in the system, thereby causing changes in cell membrane permeability for nutrients and interference with enzyme reactions. The type of cells or organs damaged by mercury depends on the amount of mercury accumulated and the sensitivity of the cells to such damage.

It is important to be aware of the fact that cell biochemistry and susceptibility to damage vary from one individual to another and these differences are even more marked between different species. Thus a certain exposure to mercury or its compounds may cause serious impairment in one individual and yet have very little effect in another.

The essential difference between intoxication by mercury vapor and by inorganic mercury entering the system by another route, is the high affinity of the former for brain and nerve cells, thereby causing damage to the central nervous system. Elimination of mercury from the brain is slow and accumulation occurs in nerve tissue. After ingestion of inorganic salts, the highest concentrations of mercury are found in the kidney and liver, although significant concentrations can be found throughout the system.

It is essential to distinguish between <u>acute intoxication</u> by a fairly large dose administered over a short period of time and <u>chronic intoxication</u> caused by absorption of relatively small doses over a prolonged period of weeks, months and even years. Clinically it is noted that the kidney is the critical organ after acute intoxication by inorganic mercury salts, whilst the central nervous system is the target from chronic exposure.

Inorganic mercury is excreted by the kidney, by the liver in the bile, by the intestinal mucosa, by the sweat glands and by the salivary glands. Urinary and fecal routes of excretion are the most important for elimination. After accumulation of mercury to significant

levels in various organs, total elimination may take many weeks. This elimination may be accelerated by administration of suitable chelating agents such as 2,3-dimercaptopropanol (BAL) or D-penicillamine.

As indications of significant mercury absorption, blood and urine analyses are most useful. In certain individuals early symptoms of intoxication have been noted when urinary excretion of mercury exceeded 200 μg (micrograms) per litre and blood concentrations exceeded 7 μg of mercury per 100 grams of blood. 'Normal' concentrations in urine and blood are generally below 20 μg per litre and 3 μg per 100 grams, respectively.

(b) Organic mercury

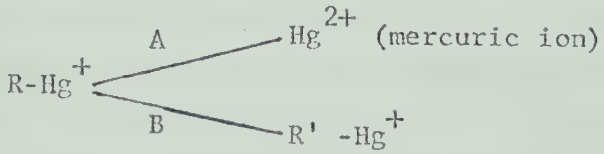
The mercury seed treatment compounds used in Alberta are all organomercurials. These compounds have the general formula R-Hg-X, where R is an organic radical (alkyl, aryl or alkoxyalkyl) and X denotes a dissociable anion, which can be organic or inorganic. The properties of the organomercury compounds are dependent mainly on the organic radical R, which influences the vapor pressure, solubility in water, chemical and biochemical properties. The anion, to some extent, influences the properties of the compound (eg. volatility), but generally has little bearing on its metabolism within the animal or human system.

Organomercurials commonly used in fungicides include the following:

R	Hg	X	Example
phenyl (aryl)	mercuric	acetate	Co-op mercury Gallatox
phenyl (aryl)	mercury	urea	Leytosan
methyl (alkyl)	mercury	dicyandiamide	Panogen Agrosol
ethyl (alkyl)	mercury	p-toluene/sulfon-anilide	Ceresan M
methyl (alkyl)	mercury	2,3-dihydroxypro-pyl mercaptide	Ceresan L
ethoxy-ethyl (alkoxy)	mercury	hydroxyde	Liqui-San"10"T

These commercially available fungicides are available as liquids or powders and only contain a relatively small amount of mercury compound. For example, the most widely used liquid treatment, Panogen, contains only 3.7 ozs. of methyl mercury dicyandiamide per gallon of liquid or 2.5 ozs. of mercury as metal. The formulation generally incorporates an intense red dye which characteristically colours all treated materials. The red coloration is an indication of the dye that is present and does not necessarily bear any relationship to the concentration of mercury compound present. The recommended rate of application for Panogen is ¾ fluid ozs. per bushel (for cereals), to give a final mercury concentration of only 12 to 24 p.p.m. (parts per million, by weight). Many of the fungicides are available in admixture with organochlorine insecticides as a combined treatment, though only about 20% of mercury fungicides are used in this way.

Organic mercury compounds can be absorbed into the system by inhalation, skin absorption or ingestion; each route may be important, depending on the manner in which the compounds are presented. Whichever the route of entry, the compounds rapidly and efficiently find their way into the blood stream for distribution to all parts of the system. Many organic mercury compounds give the appearance of being more toxic than the inorganic compounds because they are absorbed so rapidly. In the blood, organomercurials are metabolised in two different ways:



Transformation A takes place with aryl and alkoxy-alkyl compounds, breaking the carbon-mercury bond followed by an oxidation to the mercuric state. Therefore, the aryl and alkoxyalkyl compounds, after breakdown, behave in a similar manner to inorganic mercury and are distributed and excreted accordingly. The essential differences between these organic compounds and the inorganic compounds is due to the manner of absorption and the rate of breakdown in the system. Transformation B applies to the alkyl mercury compounds, the carbon-mercury bond is not broken and the final breakdown is usually to the stage where R' is a methyl group, and the combination with mercury is designated as a methyl mercury. Methyl mercury is the most toxic modification of mercury

found in the system because elimination is very slow and there is considerable risk of mercury accumulation. Ninety percent of the methyl mercury in the blood is attached to the red blood cells and thus becomes widely distributed throughout the body. There is considerable accumulation of mercury in the brain and the major effects of intoxication are related to central nervous system damage. The half-life of methyl mercury in man is about 70 days, corresponding to an excretion of about 1% per day, considerably slower than with aryl, alkoxy-alkyl or inorganic mercury. The disastrous effects of methyl mercury have been well researched and documented, the Japanese incidents Minamata and Niigata being the best known. Recent data on those affected in these areas have shown that insidious teratogenic effects can also occur before any signs of intoxication are exhibited. The primary concern with pollution by mercury compounds relates to the hazardous properties of the very stable methyl mercury combination. For example, it is now known that fish and waterbed deposits have the facility to concentrate mercury from very low levels of both organic and inorganic compounds, and then to transform them to the methyl mercury modification.

Since excretion of alkyl (methyl) mercury is so slow, urine analysis is a poor indication of excessive absorption. Blood analysis gives a better indication and mercury levels (as total mercury) should not be allowed to exceed 10 μg per 100 grams. Research is in progress to find more sensitive and selective analytical methods to determine the levels of methyl mercury present in the system.

The same criterion applies to the blood levels of aryl and alkoxy-alkyl mercury compounds. However, since these compounds are eliminated fairly rapidly from the system, urine analysis is a useful, though not reliable, added indication of mercury absorption.

IV. PERMISSIBLE CONCENTRATIONS AND TOLERANCES

(a) Human Health

The majority of known mercury poisoning cases in Alberta have occurred in the occupational environment, where individuals have been working with or in the presence of mercury and its compounds. Occupational exposures are readily controlled because criteria have been established which are known to provide satisfactory protection. The proposed Threshold Limit Value

(TLV)* for mercury vapor, airborne mercury salts and organic compounds other than alkyl mercury is 0.05 milligrams per cubic metre of air.[8] For alkyl mercury compounds the proposed Maximum Allowable Concentration (analagous to the T.L.V.) is 0.01 milligrams per cubic metre.[3] The T.L.V. may not protect the most sensitive individuals, and it is not valid if mercury is being absorbed through the skin or by ingestion from sources other than airborne material. However in controlling industrial exposures one has the added protection of carrying out blood and urine analyses, as mentioned earlier in this review.

Considering chronic exposures to mercury compounds, it is possible to extrapolate from the T.L.V. data, that daily absorption should not exceed about 1.5 μg per Kg (kilogram) of body weight for alkyl mercury compounds and about 8 μg per Kg body weight for other mercury compounds if health is to be maintained.

The WHO and FAO have jointly proposed a tolerance level of 0.05 p.p.m. (parts per million, by weight) for mercury residues in food. This level represents the concentration of mercury which may be consumed in the average diet by all individuals, irrespective of age, without the risk of harmful effects; it is not intended as a demarcation level between safe and unsafe concentrations. The Canadian Food and Drug Directorate (F.D.D.) has also recommended a tolerance level of 0.05 p.p.m. for food and drink; this authority has stated that it considers 0.1 p.p.m. to be an actionable level. Such high levels of mercury have been found in fish that the F.D.D. have temporarily recommended an actionable level of 0.5 p.p.m. This is a logical step because foods which are only consumed occasionally or in small amounts could contain much higher concentrations than 0.05 p.p.m. without presenting a hazard. The tolerances mentioned above represent the total mercury content and do not distinguish between the different mercury compounds because analytical methods are not yet generally available for doing this.

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* The T.L.V. is defined as the maximum time-weighted average atmospheric concentration to which the majority of individuals may regularly be exposed (8 hours per day, 5 days per week) without adverse effects.

(8) American Conference of Governmental Industrial Hygienists. Transactions of the 31st Annual Meeting, Denver, (1969), 182-3.

(b) Animals and plants

It is not intended, at this stage, to discuss the levels of mercury which will affect other animal and plant life; this is a complex subject which would fill another report. Suffice to say, the concentrations of different mercury compounds which are harmful vary considerably from one species to another. The important consideration is to keep mercury residues at levels sufficiently low, both to conserve the ecology and to prevent accumulation (concentration) in any species which serve as food for others. For example, fish are known to concentrate mercury compounds in the form of methyl mercury, and in some cases the concentration factor between 100 and 1000 has been reached.

V. ANALYTICAL PROBLEMS

Analysis of food, biological and other matter for mercury concentrations below 0.05 p.p.m.* presents some difficult problems, even for the specialized analytical laboratory. Although it is not intended to review the analytical chemistry of mercury, it is necessary to present some discussion of the problems inherent in the sampling and analysis in order to provide a better appreciation of the validity and meaning of the results presented in this report.

The analytical process can be separated into three distinct phases: sampling; isolation of mercury; final analysis.

(a) Sampling

The need for obtaining homogenous and representative samples is well understood by laboratories under-taking trace* analysis. It is usual for the analytical laboratory to specify or provide suitable containers free of contamination. Traces of mercury compounds are ubiquitous in the environment and the sampling techniques must be refined to minimize the possibility of contamination. For example, mercury is used as a catalyst in making certain plastics so that special care must be taken to avoid contamination from containers made from such materials. It is also necessary to recognize that mercury can be lost from samples (especially liquids) on to the surfaces

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* Looking for 0.05 p.p.m. of mercury is analogous to the problem of attempting to identify one individual in the whole population of Canada! The specialized facet of analytical chemistry devoted to the determination of such small quantities is known as trace analysis.

of the containers (plastic or glass) unless special precautions are taken; this effect can be significant at concentrations below 1.0 p.p.m. Chemical reducing conditions must be absent since mercury can be lost from the samples by volatilization as the elemental vapor. Particular attention must be given to preservation of samples, especially those of biological origin, since it has been shown[9] that many common micro-organisms can also cause significant loss of mercury by volatilization.

When all these factors have been taken into account, it is not surprising that disconcertingly inconsistent results are sometimes obtained on split or repeated specimens. In considering all the samples that have been collected in Alberta, can we honestly agree that all these factors have been taken into account and checked?

(b) Isolation of mercury

All the samples collected in Alberta have been analyzed for the total content of mercury. No attempt has been made to separate or identify the organic and inorganic fractions; although such separations are possible with time consuming complex techniques and expensive equipment. Simply analyzing the total content of mercury is sufficiently time consuming and expensive to warrant careful evaluation of any project calling for the analysis and possible identification of mercury traces.

Whichever method is used for the final analysis, it is essential that all the mercury compound present in a sample be converted to the analyzeable form. The mercury then has to be concentrated and separated from the multitude of other substances which can interfere with the final analytical step.

Mercury suffers the unique disadvantage that it is volatilized during the mineralization process which is necessary to isolate it from organic combinations. Careful control of the mineralization is essential, with special emphasis to retention of the volatilized mercury. Some organic combinations, particularly in biological specimens such as eggs or fatty materials, are particularly resistant to mineralization and several hours may be needed to process some specimens. It is necessary to strike a careful balance between the quantity of sample that can be readily processed and the lower limit of detection possible in the final analysis. It is

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(9) Magos, L., Tuffery, A.A. and Clarkson, T. W., Volatilization of mercury by bacteria. Brit. J. Industr. Med. 21, (1964), 294-8.

also important to be aware of the fact that ability to quantitatively extract seeded mercury compounds from samples is no criterion that the isolation step has been successful, because in most instances nothing is known about the state of combination in the actual specimen.

It requires an experienced analyst, working with a careful system of checks and controls to successfully analyze mercury at levels below 1.0 p.p.m. Even with the most careful techniques, inconsistencies occur and successful duplication is essential for confidence in any particular result.

Successful quantitative isolation of the mercury is the critical step in the analytical procedure - the final analytical processes are generally sufficiently sensitive and precise for most requirements.

(c) Analysis of mercury

This final step is usually dependent on an electronic instrument such as a mercury vapor meter, radiation counter, spectrophotometer, atomic absorption photometer, gas chromatograph and mass spectrometer, in order of increasing expense ($1200.00 - $20,000.00+). Summaries or reviews of these methods can be found in a number of recent publications.[2, 10-14]

Each instrument requires careful attention to final presentation of the processed sample, preparation of standards and a system of continued calibration checks. Results have to be screened for inconsistencies and artifacts. The more complex the instrument, the more skill and experience is required from the technician who has to operate it.

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(10) Swedish Royal Commission on Natural Resources. The mercury problem. Oikos Supplement 9, (1967), 8-15.

(11) Analytical Methods Committee Report. The Determination of small amounts of mercury in organic matter. Analyst 90, (1965), 515-30.

(12) Magos, L. and Cernik, A.A. A rapid method for estimating mercury in undigested biological samples. Brit. J. Industr. Med. 26, (1969), 144-9.

(13) Toribara, T.Y. and Shields, C.P. The analysis of submicrogram amounts of mercury in tissues. Amer. Ind. Hyg. Assoc. J. 29, (1968), 87-93.

(14) Truhart, R. and Boudene, C. Microdetermination of mercury in urine and biological materials. Occup. Health Review (Canada) 15, (1963), No. 2, 4-13.

Comments on the methods used to analyze samples collected in Alberta

Inconsistencies between the different laboratories are evident from scrutiny of the results presented in this report. The following comments on the methods should help to place these results in a better perspective.

(a) Neutron activation method (University of Toronto and Ontario Research Foundation)

The sample is irradiated with neutrons in an atomic reactor, which converts the mercury to a radioactive form. The radioactive mercury is separated chemically from other radioactive elements after mineralization of the sample by wet digestion. The quantity of radioactive mercury present is determined from measurements of the radioactivity. Recovery of mercury by this method is better than with the standard chemical method because it is possible to add non-active mercury as scavenger prior to digestion, thereby minimizing losses of the active mercury. The analysis takes several days to complete and the cost is not less than $60.00 per sample. The limit of detection and accuracy of the method is as follows*:

Mercury concentration (p.p.m.)	Accuracy
0.1 - 1.0	± 15% to 10%
0.01 - 0.1	± 20% to 10%
0.001 - 0.01	± 30% to 20%
less than 0.001	detectable, by order of magnitude only.

(b) Chemical method (Provincial Analyst and F.D.A. Plant Products Division laboratory, Calgary)

The methods used by these laboratories are similar and based on the best official methods [11, 15].

The sample is mineralized by wet digestion followed by extraction of the mercury as the dithizone complex in chloroform and spectrophotometric finish. The limit of detection and accuracy for this method is as follows:

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* Professor R. E. Jervis, University of Toronto. Personal communication.

(15) Association of Official Analytical Chemists. Methods of Analysis, 10th edition. Section 24.058

Mercury concentration (p.p.m.)	Accuracy* (95% confidence limits)
0.3 - 1.0	± 0.08 p.p.m.
0.2 - 0.3	± 0.07 p.p.m.
0.1 - 0.2	± 0.06 p.p.m.
0.02 - 0.1	± 0.05 p.p.m.
0.01	limit of detection ‡

* Based on duplicate 10 gram samples and taking into account losses in the digestion/extraction steps as well as the accuracy of the final spectrophtometric analysis. The 95% confidence limit on single analyses is much poorer.

‡ The limit of detection and accuracy on water samples is considerably better because a larger quantity (50 - 100 c.c.) can be taken.

The number of analyses possible per day is limited to the apparatus available for digestion and the number of experienced technicians available. A chemist, with the help of a technician and ten sets of apparatus could complete 8 single analyses per day (plus 2 controls). The estimated cost of each analysis (in duplicate) is in excess of $50.00.

Final comment

Many different agencies in Canada are performing mercury analyses by a variety of methods. From the foregoing discussion it is evident that many inconsistencies will arise until a standard procedure is accepted by all parties and a system of inter-laboratory trials is established. At the present time it would be unwise to draw conclusions on results from different laboratories until correlations have been made. The meaning of mercury levels below 0.02 p.p.m. is questioned until such a time that adequate and reliable data are available on mercury contamination in the general environment.

3. MERCURY USE IN AGRICULTURE IN ALBERTA

Mercury has many uses in agriculture as well as in other industries. Mercurous chloride (calomel) and mercuric chloride (corrosive sublimate) have been used for many years alone or in various combinations as seed treatment dips for garden seed and potato seed, prevention of turf grass diseases eg. snow mould, disinfection of tools, equipment, etc. During the last 30 years, inorganic mercuries have been replaced by organic mercuries, especially as seed treatment fungicides because: 1) Of wide spectrum of disease control, 2) Cheap and simple to apply, 3) Poisonous but generally less toxic to humans and animals than inorganics.

History: Organic mercury fungicides were first used for seed treatment in Germany in 1914, in the U.S.A. in 1926 and in Alberta in 1929. These replaced copper sulfate (bluestone) and formaldehyde. Ceresan used as a powder or a slurry wettable powder came into general use in the mid-thirties, followed by Leytosan. Panogen was the first liquid mercurial developed, used in Sweden in 1938 and in Alberta about 1946. Liquid mercurials rapidly replaced powdered dusts in the 1950's since the hazard of the dust to the applicator, handler and farmer user was overcome. Central co-op seed cleaning plants helped to change the pattern to use of liquids in seed treatment.

Need and Benefits: Seed treatment fungicides, particularly the broad spectrum mercurials reduce or control: 1) seed-borne disease pathogens such as the covered and some loose smuts, 2) soil-borne disease problems such as seed decay, seedling blight, etc.

Since the cost is low eg. 5¢ per bushel or about 10¢ per acre, the treatment of seed of cereals and flax is common in most developed countries, as it is in Alberta. Disease problems vary with climatic and soil conditions and cannot be accurately forecast. Therefore, fungicide seed treatment is recommended as a preventive measure each year.

Considerable research has been done on benefits with variable results over the years. In Alberta the following results were obtained in 5 years of field-testing in an Alberta Department of Agriculture - University of Alberta project:

Fungicide Trials 1953-57

Comparison of 5 Year Yield Averages on Thatcher Wheat

Treatment	Average Yield
Mercurials (average of 5 products)	35.0 Bu./Acre
Formaldehyde	19.9 Bu./Acre
Check (No Treatment)	32.0 Bu./Acre

Recent work done by Dr. H. M. Austenson, University of Saskatchewan, in 1968: 148 farmers' samples of wheat from the three prairie provinces were treated with liquid mercury seed treatment and tested against non-treated checks at three locations. Yield increases for the treated seed averaged from 0.9 bu./acre at Indianhead to 1.2 bu./acre at Saskatoon, and 1.9 bu./acre at Melfort. This occurred under near optimum conditions e.g. average germination 92%, average bushel weight 63.6 pounds under favorable conditions for germination and emergence. Tests were continued in 1969 though the results are not ready at this time.

Mr. H. A. H. Wallace, Canada Department of Agriculture, Research Station, Winnipeg reports that treated flax seed yielded 20% more at Winnipeg and 15% more at Beaverlodge, Alberta in 1968.

Use in Alberta: based on reports from seed cleaning plants, agri-chemical company sales and Alberta Department of Agriculture seed drill-box surveys:

Estimated Use of Mercury Seed Treatment Fungicides, 1968

Cereal grains seeded on 14,000,000 acres used	19,000,000 bu.
30% untreated	- 5,700,000 bu.
57% treated with mercury fungicides	-10,830,000 bu.
13% treated with non-mercury fungicides	- 2,470,000 bu.

Metallic Mercury estimated used in agriculture:

Cereal seed treatment	-	3.7 ton
Other seed	-	0.1 ton
Other uses in agriculture	-	0.1 ton
Total use in agriculture		3.9 ton

Data is not available on industrial, manufacturing and other uses or sources of mercury in Alberta. Besides the natural background of mercury in the total environment there is continual emission from burning and combustion by motors, from chimneys and stacks, garbage incineration, by gas and oil flare pits, etc. Data from other developed countries indicates that agriculture uses less than 10% of total mercury.

The volume of mercury seed treatment has remained at about the same level for 20 or more years. There has been a recent decrease with change-over to non-mercurials, drill-box treatment or no treatment. Records from the 65(+) municipal co-op seed cleaning plants also indicate this:

	1964-65	1965-66	1966-67	1967-68	1968-69
Total Seed Cleaned	11,967,287	13,419,081	15,616,256	17,084,273	16,940,047
Bu. Treated Fungicide	4,967,137	5,394,693	6,019,518	6,385,437	4,975,788
Bu. Treated Insecticide	1,055,850	1,166,772	1,155,834	1,942,948	765,258

A list of "Fungicide Seed Treatment Compounds" commonly used in Alberta is attached.

Developments

Recently a systemic non-mercurial fungicide, Vitavax, was registered for use in Canada. It controls loose smut of barley and wheat as well as the other diseases normally controlled. Unfortunately it will likely cost about five times more and a liquid formulation is not presently available.

The main problem of contamination to farm livestock and poultry, and probably to wildlife, has resulted from left-over treated seed. Drill-box treatments have provided a partial solution eg. the farmer treats the seed in the seed drill-box as needed. However farmers dislike the nuisance of spending valuable time during planting operations and the dust hazard is always present. But this technique should be promoted to avoid left-over treated seed which is sometimes dumped.

All mercury seed treatment labels are being reviewed by the Canada Department of Agriculture, Ottawa with provincial participation and further restrictions are expected. Since 1968 all seed treatment chemicals were compelled to carry a heavy red dye to mark treated seed. Plans are underway to incorporate a fluorescent marker to assist in detecting trace amounts in commercial grain, feed, etc.

A Working Party under the Canada Committee on Pesticide Use in Agriculture (CCPUA) is completing a report on proper use and disposal of treated seed.

Safety, Management and Future

Considerable publicity has been provided in the past on hazards and safety measures. In 1966 a safety poster "Treated Seed is Poisonous" was developed and distributed for use in seed cleaning plants, grain elevators, farm seed bins, etc. The same message has been stamped on invoices for all treated seed leaving seed cleaning plants. The Canada Department of Agriculture,

Ottawa has supplied about 10 safety posters on pesticides which have been distributed by the Alberta Department of Agriculture. Four of these concern proper use of treated seed.

Several farmers and grain buyers have been charged and fined for allowing treated seed to get into market grain. The 1969 Agricultural Chemicals Act and proposed regulations will provide the necessary legislation to enforce proper and safe use, handling, transport and disposal of treated seed.

The Alberta Department of Agriculture has promoted and supported research and development for non-mercuric seed treatments. Liquid formulations are not available and are required for use in the 68 co-op plants equipped with liquid treaters, for ease of application on the farm, and to avoid the nuisance and hazards of dust formulations. Laboratory and field trials have been conducted in recent years in cooperative work. In 1969, the Alberta Department of Agriculture tested 31 non-mercuric seed treatments at the Beaverlodge Research Station and the University of Alberta Parkland Farm. Of these at least five liquid non-mercurial treatments are promising replacements for the mercurials. Some of these have gone through two years of field testing and likely will be registered for use in Canada within two years.

In the meantime action is underway with farm organizations to tighten up possible sources of contamination eg. spilled treated seed around seed bins and seed cleaning plants, transport (proper tarping), spillage during planting operations, and proper disposal by burning or burying at farm dumps and municipal nuisance grounds.

FUNGICIDE SEED TREATMENT COMPOUNDS

INORGANIC

A. Metals eg. Chloride of Mercury; Copper Sulfate (Bluestone); Bordeaux Mixture (Bluestone + slaked lime).

B. Non-Metals eg. Sulfur dust; Chlorox; Carbon Tetrachloride.

ORGANIC

A. Dithiocarbamates eg. Thiram (Arasan); Ferbam; Dithane (Maneb, Zineb).

B. Heterocyclic Nitrogen Compounds eg. Captan (Orthocide).

C. Carbonyl Compounds eg. Formalin, Dichlone (Phygon), Chloranil (Spergon).

D. Phenolic Compounds eg. Cresol (wood preservative); Dinitros.

E. Halogenated and Nitrated Aromatic Compounds eg. Chloramine; Pentachlorophenol (Penta); Hexachlorobenzene (HCB); Pentachloronitrophenol (Tritisan); Pentachloronitrobenzene (PCNB or Terrachlor).

F. Organometallic Compounds eg. Organomercury Compounds. Phenyl mercury acetate (PMA) - Gallatox, Coop Mercury, Canuck Mercury.
Phenyl mercury urea - Leytosan.
PMA + ethyl mercury chloride - Agrox C, San, 77 Mercurial.
Methyl mercury dicyandiamide - Panogen.
Ethyl mercury p-toluene sulfonanilide - Ceresan M.
Ethyl mercury 2, 3 - dihydropropyl mercaptide - Ceresan 100.
Phenylamino cadmium dilactate + PM formamide - Puraseed.
Hydroxymercurichlorophenol - Semesan.

1) Seed treatments are formulated as liquids or dusts (wettable powder + water = slurry) as a means of easy application. Liquids are used in seed plants with special treating equipment. Dusts are bulkier and require less mixing eg. drill-box treatment.

2) Fungicides mixed with insecticides for Combination or Dual Treatment for diseases and wireworm control (+ Aldrin, Heptachlor or Lindane). For flea beetles on rape (Captan or Thiram + Lindane) e.g. Gammasan, Lindasan, Thiralin.

3) Combinations of Fungicides eg. Green Cross Res-Q (HCB + Captan + Maneb) - to provide a non-mercury for disinfestation and seed protection.

4. INVESTIGATIONS OF MERCURY RESIDUES IN WILDLIFE BY THE CANADIAN WILDLIFE SERVICE.

In Sweden, mercury has been the chemical pollutant with the most serious wildlife and environmental consequences, comparable in position to dieldrin in Britain and DDT in North America. Mercury used in Sweden as a seed dressing to reduce fungal attack on seed grain was picked up by seed-eating birds, including pheasants, at seeding time. This caused the death of numbers of seed-eating birds and also caused widespread declines in populations of birds of prey which fed on seed eaters, since mercury is transferred and concentrated in food chains. Mercury used to control fungal growth on wood pulp also led to contamination of rivers below pulp mills, and this source, in conjunction with other industrial sources, led to food-chain concentrations in fresh water and coastal areas so that fish caught commercially, especially high food-chain members such as northern pike, contained mercury levels dangerous for human consumption. Many commercial and sports fisheries were closed, a serious loss in a country that consumes a great deal of fish. These aquatic concentrations of mercury also led to sharp declines in populations of fish-eating birds.

Preliminary Investigations in Canada

For several years we have known that a large proportion of the grain sown in Canada is treated with mercurial fungicides, also that mercury is used in some pulp mills and in large quantities in certain industries in this country. Because of the similarities between Canadian and Swedish uses, the Canadian Wildlife Service established a research project to study possible side effects in Canada. Thus, in 1968, a three year contract in support of such a project was established with a graduate student at the University of Western Ontario.

After preliminary research into the current uses of mercury in Canada, a preliminary survey was made of wildlife forms most likely to be contaminated, judging by the Swedish experience. That survey in the early summer of 1968 included seed-eating birds and birds of prey in the western prairies and was dovetailed with a current Wildlife Service study of the effects of pesticides on prairie falcons and other raptorial birds. Figure 1 shows the distribution of samples collected for mercury analysis in the prairie areas.

Although it was recognized that high levels of mercury contamination would be a serious environmental hazard, regardless of the source, it was

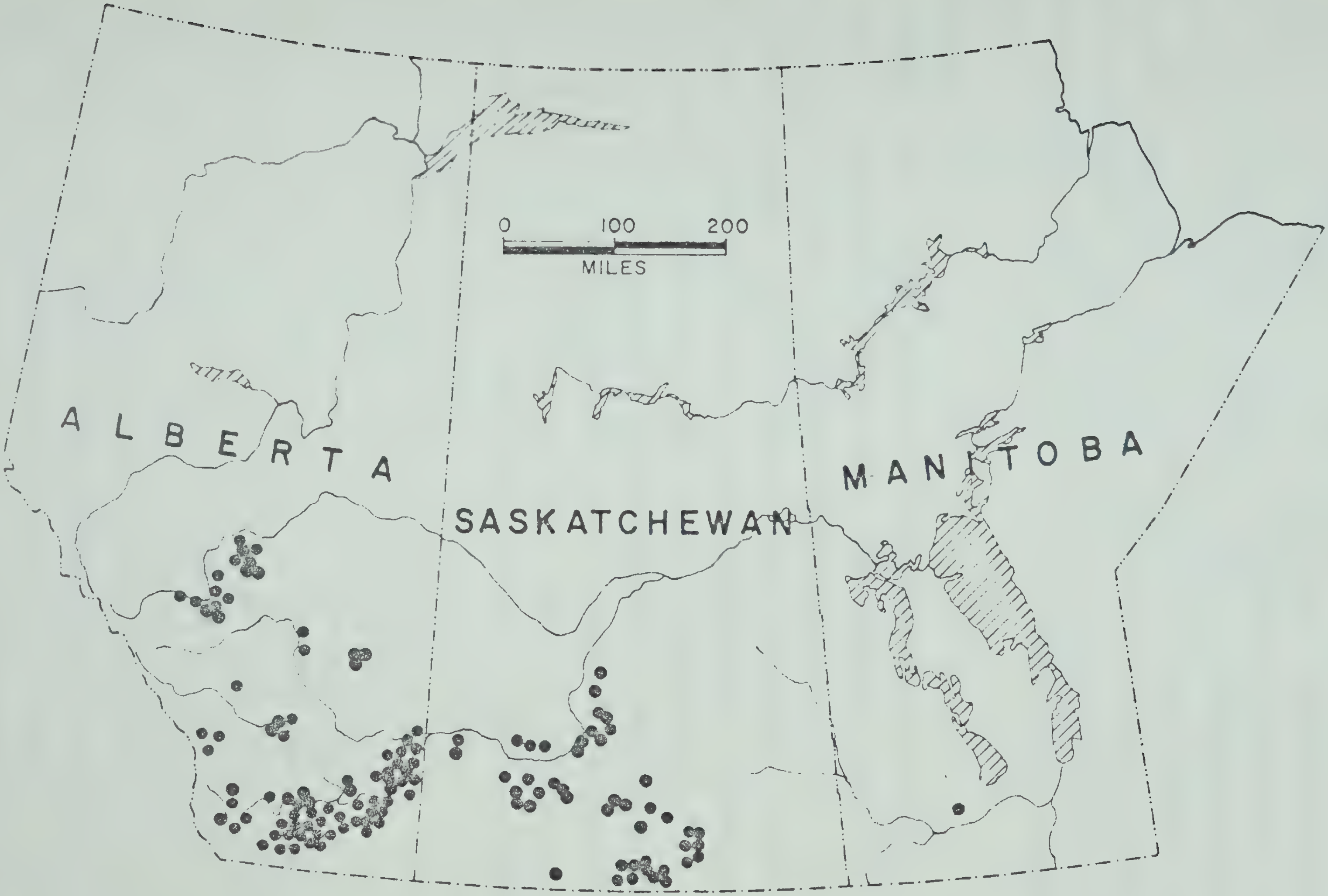

Fig. 1. Distribution of samples collected for mercury analysis in 1968.

necessary to establish some measure of the natural "background" levels of mercury in the environment in order to determine the presence of additional artifically introduced contamination.

Samples of biological material collected were therefore analyzed by the neutron activation technique developed in Sweden and established internationally as the most sensitive method available. This more sensitive method was required in order to determine residue levels resulting naturally from mercury occurring in the environment. The samples were sent to Gulf General Atomic Incorporated, California for analysis by the Ontario Research Foundation, which to date has done all of the Wildlife Service Pesticide analyses.

1968 Results

Because small amounts of mercury are known to occur naturally in the environment some residues were expected, and indeed were found in all samples and on the basis of residue determinations from areas where mercury is not used it appeared that background levels for mercury in Western Canada ranged from 0.008 to 0.035 p.p.m. Presumably,therefore, higher concentrations in tissue samples resulted from other kinds of contamination.

The results of the preliminary survey arrived in late March 1969 and showed that mercury was being significantly concentrated in prairie seed-eating birds and rodents (Table 1), and was being then transferred to birds of prey to the extent that it apparently was causing hatching failures in their eggs. Both DDT and mercury appeared to be involved in the present major population declines in certain western birds of prey, for the role of DDT had already been identified by the Canadian Wildlife Service.

Where possible, samples of seed-eating birds and mammals were collected from treated and untreated areas in order to establish whether there was any correlation between mercury residues and the use of mercurial fungicides in western Canada. The results of residue determinations from five species of seed-eating animals sampled in relation to treated and untreated areas are shown in Table 2. Although the number of samples was small the results established a direct correlation between high mercury residue levels in organisms and areas of mercurial seed treatment. It should be stated however that the actual amount of mercury added to the environment by seed treatment is small when compared with industrial sources, and a wildlife problem exists mainly because mercurial compounds are added to a preferred food for seed-eating animals and distributed in farming areas at a time when other food

Table 1. A Summary of Mercury Residue Determinations in Alberta Wildlife Collected in 1968

Seed Eating Animals	n*	Tissue	Mean p.p.m. Wet Wgt.	Birds of Prey	n	Tissue	Mean p.p.m. Wet Wgt.
Passerine Birds	(8)	Br. muscle	0.49	Large Falcons	(12)	Eggs	0.63
Passerine Birds	(16)	Liver	0.55	Hawks & Eagles	(21)	Eggs	0.23
Doves and Pigeons	(12)	Liver	0.56	Owls	(3)	Liver	3.0
Waterfowl	(6)	Eggs	0.05				
Upland Game Birds	(11)	Liver	2.4				
Ground Squirrels	(5)	Liver	1.5				

*n = number of samples

sources are scarce.

Table 2. Significance of mercury residue determinations of samples from treated and untreated areas.

Group	species*	tissue	(n)	Hg residues ppm treated areas	(n)	Hg residues ppm untreated areas
Seed eating birds	a	m	(4)	1.73	(5)	0.13
	b	l	(5)	2.78	(3)	1.25
	c	l	(6)	1.41	(2)	0.03
Seed eating mammals	a	l	(3)	2.19	(3)	0.29
	b	l	(2)	0.45	(2)	0.01
			(20)	2.085	(15)	0.358
95% confidence limits				(1.336-2.834)		(0.091-0.625)

m = muscle l = liver n = number of samples

* species names withheld because the data are part of an unpublished report.

Among the seed-eating birds in the 1968 survey were livers of 8 Hungarian partridges and 8 pheasants (Table 3). By extrapolation to estimates of breast muscle concentrations, many of those birds looked to be unsafe for human consumption, using published Swedish and FAO/WHO criteria. Wildlife Service biologists brought this to the attention of the Minister of Lands and Forests and a joint plan was drawn up with the provincial biologists to sample birds from the major pheasant and partridge hunting areas in Alberta for mercury residues in late June and early July, 1969. Pheasants and Hungarian partridge were collected from four separate areas of southern Alberta. Samples of breast muscle of these birds together with similar tissue from a control sample of hatchery pheasants were then submitted to Gulf General Atomic Incorporated, California, for mercury analysis by neutron activation. The results of these analyses were received and submitted to the Alberta Inter-departmental Committee on Pesticides September 8, 1969 and are shown in Table 4.

The average concentration in the meat from four different areas of southern Alberta is 0.45 ppm, with a small range of 0.24 to 0.79. A control sample of hatchery pheasants contained 0.026 ppm. This Alberta average of 0.45 ppm was four and a half times higher than the actionable level of 0.1 ppm established by the Department of Health and Welfare in Ottawa.

Table 3. 1968 mercury residues in Pheasants and Hungarian Partridge collected in Alberta in 1968

No.	Sample	Location	Tissue	Hg. residue
20	1 partridge	Seven Persons	Liver*	2.59
100	1 partridge	E. of Calmar	Liver	0.699
129	1 partridge	E. of Lethbridge	Liver	0.447
5	1 pheasant	S.E. of Bow Island	Liver	3.80
7	1 pheasant	E. of Seven Persons	Liver	5.92
8	1 pheasant	E. of Lethbridge	Liver	1.14
11	1 pheasant	Lethbridge	Liver	0.589
12	1 pheasant	Lethbridge	Liver	0.484
13	1 pheasant	S.E. of Taber	Liver	2.13
131	1 pheasant	E. of Lethbridge	Liver	5.21
145	1 pheasant	S.E. of Lethbridge	Liver	3.37
			Mean -	2.398
		estimated mean breast muscle levels		0.599

* Liver levels can be expected to be 2 to 4 times greater than the breast muscle which suggest that the mean muscle tissue levels in the 1968 samples were in excess of 0.5 p.p.m.

Table 4. Mercury residues in composite samples of breast muscles of wild Alberta adult Hungarian partridges and adult male pheasants collected in late June and early July, 1969.

Species	No. in Sample	Location	Mercury in ppm (wet-weight)
Pheasant	3	Bow Island to Taber	0.794
Partridge	6	Bow Island to Taber	0.450
Pheasant	3	Bassano to Brooks	0.413
Pheasant	3	Bassano to Brooks	0.238
Partridge	3	Bassano to Brooks	0.361
Pheasant	3	Lethbridge to Raymond	0.259
Partridge	1	Lethbridge to Raymond	0.314
Pheasant	2	Claresholm to Vulcan	0.679
Partridge	2	Claresholm to Vulcan	0.527

These data were reviewed at a special meeting of the Alberta Interdepartmental Committee on Pesticides on September 12th, 1969, and the Committee recommended to the Provincial Government that the 1969 pheasant and partridge hunting season be closed in Alberta and that the use of mercury seed treatments be reviewed.

In addition to the specific mercury problems with upland game birds of Alberta, the Canadian Wildlife Service will continue to investigate all aspects of mercury pollution in the Canadian environment in an attempt to determine other sources of contamination, mechanisms of transfer and the effects of mercury and other biocides on Canadian wild life.

5. A SUMMARY OF THE SPECIAL MEETINGS ON THE MERCURY PROBLEM HELD BY THE ALBERTA INTERDEPARTMENTAL COMMITTEE ON PESTICIDES.

The Alberta Interdepartmental Committee on Pesticides (AICP) was established in 1965 as an operational, advisory and liaison committee for the Government of Alberta, responsible to the Minister of Agriculture, and through his office to the Minister of Health, the Minister of Lands and Forests, and federal Ministers if necessary, concerning matters of policy or extra expenditures in pesticide problems. A.I.C.P. membership is composed of representatives from the University of Alberta (Entomology), provincial departments of Agriculture, Health, Lands and Forests (wildlife), and federal Agriculture, Health (Food and Drug), and Wildlife.

A special meeting of the A.I.C.P. was held September 12, 1969 following receipt of a letter of September 8 from Canadian Wildlife Service on mercury residues in Alberta Pheasants and Partridge. Members of the Canadian Wildlife Service supplied details on survey work during 1968-69 on pesticide residues in bird life on the prairies. There was considerable discussion on methods of sampling and analysis, confirmation and reliability of results, and the significance of the data from the small sample i.e. nine laboratory analyses on pooled samples of 14 pheasants and 12 Hungarian partridge. However, the 1968 samples of mercury-contaminated wildlife were also considered.

Some discussion took place on work done in 1967 by the Alberta Department of Agriculture on feeding trials of mercury-treated grain to domestic poultry to obtain rates of excretion of the mercury. Health representatives outlined the effects of mercury on human health and expressed concern about the levels found in game birds. The Fish and Wildlife Division reported they had considered all aspects and were prepared to close the hunting season on pheasants and Hungarian partridge. Dr. J. D. Ross required an early recommendation from the A.I.C.P. for consideration of his Department, the Cabinet, and for release to the news media.

The following resolution was therefore moved "That the hunting season for Pheasants and Hungarian partridge should be closed for 1969". (CARRIED 6-3)

Dr. J. D. Ross expressed the concern of Cabinet on the situation and the need for a prepared statement for release to the news media. A Statement For Release To The News Media was prepared and supplied to Dr. Ross (copy in Appendix II).

Further discussion took place on the possible source of the mercury and

the need for further investigation on many aspects of the situation. A Working Subcommittee of the A.I.C.P. was therefore set up as follows (representatives in brackets):

Dr. W. G. Evans, Chairman; Dr. S. B. Smith (Mr. G. R. Kerr): Dr. W. E. Stevens (Mr. R. W. Fyfe): Mr. J. B. Gurba (Mr. L. K. Peterson): Dr. C. R. May (Dr. H. Buchwald): Dr. J. G. O'Donoghue (Dr. J. Howell): Mr. W. D. Charles.

This Working Committee, which would be responsible for a continuing investigation of the mercury problem, agreed upon the following general plan for further research:

I. Immediate sampling of 60 to 100 pheasants and Hungarian partridge across the province with emphasis on southern Alberta to duplicate the June-July, 1969 survey area. Fish & Wildlife Officers to submit skinned, frozen specimens to Fish & Wildlife Laboratory, Edmonton, with history tag showing: species, age, sex, location (legal land description if possible), date and name of collector. Dr. J. Howell, Veterinary Services Laboratory will receive half split sample, other half to Canadian Wildlife Service. The Veterinary Laboratory will analyze as rapidly as possible through Provincial Analyst using standard methods with cross-check by Canada Department of Agriculture Plant Products Laboratory, Calgary, and if possible Food and Drug Laboratory, Vancouver. Canadian Wildlife Service and Fish and Wildlife will analyze at least some split samples through neutron activation method as soon as possible.

II. Feeding Trials - to be set up as soon as possible to get data on contamination levels from ingestion of mercury treated grain and decontamination period. Crop Protection and Pest Control Branch to supply sufficient wheat treated at recommended rate of mercury by a co-op seed plant, with an equal amount of untreated wheat. Details of this work can be found in Part 7.

III. Investigation of areas where high mercury levels in birds were found to determine farm practices or other activities that might provide source of contamination i.e. transfer of treated seed from seed plant to farm, spillage around seed bins and farm yard, handling of treated seed during planting operations in spring, history of seed treatment on farms in area where bird samples taken, feeding habits of pheasants and Hungarian partridge, etc.

An accurate history of samples will be necessary for follow-up investigation. The survey results will depend on the team work of game biologists and agrologists who are familiar with the habits of the two bird species and regular farm practises. Besides checking possible contamination from mercury treated seed, other potential sources should be investigated, including soil sampling, mercury levels in seedling grain, other uses and sources of mercury.

Individual members of the Working Subcommittee would work out final details on investigation procedure and co-ordination of work. Periodic checks on progress should be made with an interim report expected for the October 9 or 10 meeting of the A.I.C.P.

The second special meeting of the A.I.C.P. was held on October 9, 1969. It was agreed that the results of the investigation into mercury residues in pheasants and partridge should be discussed first. A total of some 346 game birds had been submitted by Fish and Wildlife Officers across the province and split for analysis by various agencies. The Provincial Analyst had analyzed 56 pheasants and Hungarian partridge and 4 pooled lots of livers with results listed for 39 birds from southern Alberta. Analysis results varied considerably for both adults and juveniles from Nil to 0.8 p.p.m. Results from other laboratory cross-checks were not available except for a general statement from the University of Toronto on 10 samples done by the neutron activation method.

Considerable discussion took place on the results and implications for human and animal health. Mr. J. A. Keith, Canadian Wildlife Service, Ottawa, outlined investigations underway in Canada and the work done on mercury problems in Sweden and other countries. The possibility of recommending open hunting with a warning was proposed. Most members felt that a larger analysis sample was needed for the south and also results for the area north of the Trans-Canada highway were necessary to determine the situation for the rest of the province.

The following resolution was moved "That decision should be deferred to a noon luncheon meeting, Thursday, October 16, in Conference Room, O.S. Longman Laboratory Bldg., when further analyses results would be reviewed by members and discussed with Prof. Jervis (a mercury analyst) of the University of Toronto". CARRIED.

It was agreed that:

1) Analyses by the Provincial Analyst and other laboratories should proceed in order to obtain as much data within the following week.
2) The feeding trials should proceed: (a) by cage trials, (b) in open pens at the Brooks hatchery.
3) Follow-up investigations, particularly on birds with higher mercury levels, should be planned after the October 16 meeting to attempt to determine sources of contamination.

Visitors present from federal agencies and other provinces indicated that information from Alberta would be useful in planning investigations and decision making. The possibility of exchanging information between interdepartmental committees in the 4 western provinces and the federal committee (F.I.C.P.) was discussed and considered worthwhile for liaison and coordination.

The following was moved "That the A.I.C.P. request clearance from the Minister for the exchange of minutes between provincial and the federal interdepartmental committees and the release of information to the provincial ministers, particularly in western Canada, possibly at the deputy or minister level." CARRIED.

In discussion on the spillage of treated grain along roadsides, the Committee was informed that starting January 1, 1970 the Noxious Weeds Act would require all grain being moved on public roads to be covered by a tarpaulin, with enforcement by Department of Highways inspectors. It was suggested that the movement, handling and disposal of treated seed should be further controlled by regulations under the Agricultural Chemicals Act.

A telephone report from the Municipal District of Willow Creek expressing concern about treated seed dumped at the local nuisance grounds was brought up. Most garbage dumps in the province were used for disposal of treated seed. It was agreed that such should be burned, covered or buried as soon as possible.

The third special meeting of A.I.C.P. was held October 16, 1969.

Since September 85 birds were analyzed by the Provincial Analyst consisting of 56 pheasants (12 adults, 44 juveniles) and 29 Hungarian partridges (6 adults, 23 juveniles). Of the 38 recent analyses, 4 were over the Food and Drug actionable tolerance for mercury ranging from 0.1 to 0.365 p.p.m.

Dr. R. E. Jervis of the University of Toronto outlined analyses by the neutron activation technique and general work on mercury residues. The sensitivity of analytical methods was still a matter of controversy. The neutron activation method was considered the best, especially at levels below 0.1 p.p.m., but laboratory procedure and experience was quite important.

There was considerable discussion on the data and its significance. Some members felt that the matter was sufficiently resolved as far as human health was concerned. Others questioned the reliance on data produced by conventional analyses and felt further check-out by the neutron activation method should be secured.

The following resolution was moved "That from the analyses data available, the A.I.C.P. is of the opinion that the levels of mercury in pheasants and Hungarian partridge is not a significant problem to human health, and that the hunting of these game birds could be permitted with information on the situation and risks supplied to the public". Upon further discussion it was obvious that consensus of opinion was likely not possible.

The following was then moved, "That the motion be tabled until the next meeting when further results of analyses by the University of Toronto and Gulf General Atomic, California, would be available". CARRIED.

A motion presented for the Working Subcommittee to make the decision on the tabled motion was defeated. The chairman would call another meeting as soon as the necessary data was available.

The regular fall (tenth) meeting of the A.I.C.P. was held December 17, 1969, with a review of proceedings of the three special meetings.

The tabled motion from the October 16 Special Meeting was discussed. It was considered that the original motion was now irrelevant since the 1969 hunting season had passed.

It was moved "That the tabled motion from the October 16 Special Meeting and the original motion should be struck from the record". CARRIED.

The Working Subcommittee had met several times to coordinate investigations and the various work programs, and on December 9 prepared a report and statement for the A.I.C.P. Printed copies of the statement were distributed and discussed in depth. The A.I.C.P. agreed with the decision to exclude data from the Canada Department of Agriculture Plant Products Laboratory in Calgary since their report stated that the method was not reliable below 0.2 p.p.m. There was considerable difference in some results from the three laboratories (California, University of Toronto and the Provincial Analyst) but after

experience was developed, later results were more consistent. (See Appendix I).

The report and recommendations of the Working Subcommittee were discussed in detail as follows:

1) It was moved "That the Provincial Analyst Laboratory be used for future mercury determinations". CARRIED.

   It was suggested that some replication and split-sampling was necessary. Also the Provincial Analyst would be asked to join the Working Subcommittee.

2) Feeding Trials - It was reported that 14 caged pheasants fed mercury treated grain were being analyzed. Some 70 penned pheasants were being fed mercury and wireworm insecticide treated grain at the Poultry Farm at Oliver. Analyses would be completed in February with 84 pheasants for mercury determination and 70 for insecticide.

3) Work Plans for 1970 were discussed in connection with need, extent and cost.

It was moved, "That wild seed-eating and non-seed-eating birds should be monitored for mercury and insecticides in 1970". CARRIED.

It was moved, "That the A.I.C.P. approves in principle and encourages the proposal submitted by the Fish and Wildlife Division for extensive research and investigation into pesticides in birdlife". CARRIED.

The details of the research program would be worked out by Fish and Wildlife and Canadian Wildlife Services. The Fish and Wildlife Division will submit work load requirements for the Dairy and Food Laboratory to the Food Residue Committee planning meeting in January. If the Fish and Wildlife research project proceeds an additional 230 samples for mercury determination by the Provincial Analyst Laboratory would be necessary, otherwise 150 samples are planned as listed below (66 + 84 from feeding trials):

Tentative Plan for 1970 Bird Sampling and Analysis

	Samples	Pooled by 10
Before planting	120	12
During planting (June)	120	12
After planting (July)	120	12
September - province wide	300	30
	660 birds	66 analyses

4) Laboratories Mercury Data - The data from the various laboratories was summarized to indicate the complexities of mercury determination and interpretation for practical purposes. These data are presented in Table 6 in Part 6.

It was moved, "That the Statement of the A.I.C.P. on the Mercury Problem in Relation to Upland Game Birds (in Appendix II) be approved". CARRIED.

It was reported that Dr. J. D. Ross had requested a comprehensive report, including history, maps, charts, etc., and it was considered this could be developed by staff from the various departments.

It was recommended that the remaining 300 or so bird specimens should be pooled to reduce analyses, and mercury determinations carried out upon arrangement by Fish and Wildlife and Veterinary Laboratory staff.

6. SUMMARY OF DATA ON SAMPLING AND ON MERCURY RESIDUES IN PHEASANTS AND HUNGARIAN PARTRIDGES

This part of the report presents in tabular form data on numbers of birds collected in September for mercury analysis, where these birds were collected in the province and the numbers analyzed so far (Tables 5, 6, and 7). Table 6 shows a comparison of analyses carried on by three different agencies on split samples of birds and in general there is close agreement. Table 7 summarizes all of the analyses that have been done to date but considerably more samples have yet to be analyzed by the Provincial Analyst.

Appendix I presents the collection and residue data, as well as information on sex, weight, and species of each bird individually.

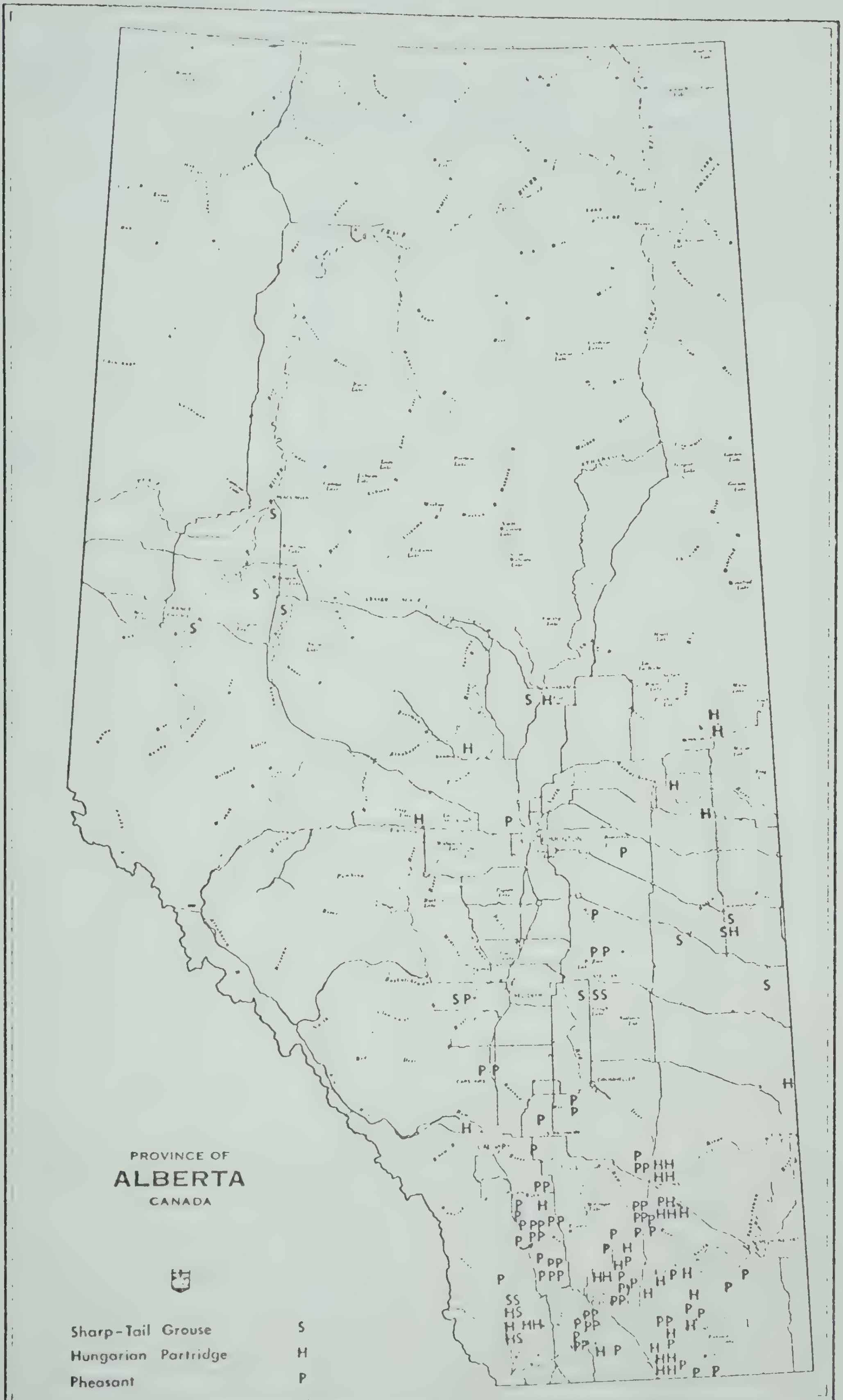

Fig. 2

Distribution of 128 Upland Birds Collected in September, 1969 that were analysed for mercury.

Table 5. TOTAL UPLAND BIRDS COLLECTED IN SEPTEMBER, 1969 FOR MERCURY ANALYSIS

CONSERVATION OFFICER DISTRICT	PHEASANTS	HUNGARIAN PARTRIDGE	SHARP-TAILED GROUSE	TOTAL BIRDS COLLECTED
Pincher Creek	1	8	5	14
Lethbridge	24	13	0	37
Foremost	8	8	0	16
High River	15	1	0	16
Cardston	6	0	0	6
Brooks	12	8	0	20
Medicine Hat	14	11	6	31
Strathmore	10	6	0	16
Calgary	0	2	0	2
Drumheller	8	13	10	31
Oyen	0	10	6	16
Olds	4	7	0	11
Red Deer	1	7	0	8
Stettler	2	4	3	9
Rocky Mountain House	0	0	3	3
Provost	0	5	9	14
Camrose	1	9	0	10
Edmonton	1	5	0	6
Evansburg	0	1	2	3
Vegreville	1	4	2	7
Vermilion	0	4	6	10
St. Paul	0	6	13	19
Bonnyville	0	6	9	15
Cold Lake	0	7	6	13
Lac la Biche	0	1	6	7
Athabasca	0	0	4	4
Barrhead	0	3	12	15
Valleyview	0	0	5	5
High Prairie	0	0	7	7
Grande Prairie	0	0	5	5
Peace River	0	0	6	6
	108	149	125	382

Table 6. COMPARISON OF MERCURY ANALYSES IN P.P.M. (WET WEIGHT) BY VARIOUS LABORATORIES (SEPTEMBER, 1969 SAMPLES)

SAMPLE NO.	CAL. GULF ATOMIC	UNIV. TORONTO	PROV. ANALYST
1	0.006	0.050	NIL
9	0.035	0.020	NIL
15	0.812	0.050	NIL
20	0.033	0.026	NIL
21	0.012	0.028	NIL
23	0.029	0.034	NIL
24	0.015	0.052	0.04
25	0.017	0.013	0.25
27	0.014	0.031	0.02
42	0.027	0.028	NIL
43	0.106	0.037	0.36
48	0.014	0.021	0.17
89	0.007	0.025	NIL
RANGE WET WT. MERCURY P.P.M.			
0.000-0.049	11	10	10
0.050-0.099	0	3	0
0.100-0.499	1	0	3
0.500-0.999	1	0	0
	13	13	13

Table 7. SUMMARY OF MERCURY ANALYSES BY VARIOUS LABORATORIES

OF GAME BIRDS* COLLECTED IN 1969

LABORATORY	CAL. GULF ATOMIC		UNIVERSITY TORONTO	PROV. ANALYST			PLANT PRODUCTS
COLLECTION PERIOD	EARLY JUNE EARLY JULY	LATE SEPT.	LATE SEPT.	LATE SEPT.		JAN. 14 1970	LATE SEPT.
RANGE WET WT. MERCURY P.P.M.							
0.001-0.049	0	40	22	25	32	7	0
0.050-0.099	0	0	1	3	3	3	0
0.100-0.499	6	2	1	16	4	4	12
0.500-0.999	3	1	0	2	0	0	0
NUMBER OF ANALYSES	9	43	24	46	39	14	12
DATE RESULTS WERE REPORTED	SEPT. 8	NOV. 4	NOV. 26	OCT. 7	OCT. 15	JAN.14	OCT. 29

* Some of the birds sent to the various laboratories were split samples while others were not.

7. REPORT ON FEEDING TRIALS OF PESTICIDE-TREATED SEED TO CAGED PHEASANTS

a. Laboratory Trials

When it was first found that excessive mercury residues were present in the tissues of some Alberta seed-eating game birds, the question arose as to whether these levels would have fallen sufficiently in the interval between their discovery and the opening of the hunting season. There was no reliable information on the rate of regression of mercury levels with time in game birds. It was felt that this information was of vital importance for the assessment of future situations. It was requested by the Alberta Interdepartmental Committee on Pesticides that feeding trials at the laboratory be carried out in order to obtain this information.

Pheasants from the wildlife establishments at Brooks were placed in individual cages in the laboratory and fed uncontaminated feed for a period to allow them to become used to laboratory conditions. On November 10th and for the next fourteen days, eight of the pheasants were fed wheat which had been treated with a mercurial fungicide at a seed treatment plant. The remaining four birds were given uncontaminated wheat. At the end of the feeding period, two treated birds and one control bird were killed and the remaining birds given uncontaminated feed for the remainder of this experiment. Tissues were harvested from these three birds for mercury analysis. Similar groups of birds were killed on December 8th, 1969, and January 5th, 1970, and the last birds will be killed on February 2nd. Tissues from all of these birds will be analysed for mercury. The quantity of treated grain eaten by each bird has been recorded.

It is hoped that the information from this experiment will indicate what levels of mercury in tissues were reached following the ingestion of known quantities of treated grain (the concentration of mercury in the treated grain being also known). Information should also enable the development of a curve or equation representing the rate of regression of mercury with time.

b. Feeding Trial in pens at Oliver

Because of the small numbers of birds involved in the laboratory experiment, it was felt necessary to carry out further experiments using larger numbers of birds. Permission to use a number of identical pens at Oliver was obtained from the Poultry Branch. Fifteen or sixteen pheasants of mixed sexes were placed into each of five pens. One of these pens was

to serve as a control group and receive uncontaminated feed throughout the experiment. The other four pens of pheasants were given barley treated with a mercurial fungicide and a chlorinated-hydrocarbon insecticide (the equivalent of fungus and wire-worm treatment). This feed was given for thirteen days. On the last day of treatment, three birds of mixed sexes from each treatment pen and four birds of mixed sexes from the control pens were killed and tissues harvested for mercury and chlorinated-hydrocarbon residue analysis. Similar groups of birds will be killed at three week intervals and tissues harvested for analysis. We hope that this experiment will increase our knowledge with regard to levels and persistence of mercury residues in the tissues of birds following the ingestion of mercury treated grain. We also hope to obtain similar information with regard to chlorinated-hydrocarbon residues following the ingestion of grains which have been treated for the control of damage due to wire-worms. Some difficulties have been experienced which we feel are related to the confinement of birds that are virtually wild and also possibly to the unpalatability of treated grain.

APPENDIX I
(Pages 44 - 55 inclusive)

RESULTS OF MERCURY ANALYSES OF 128 GAME BIRDS COLLECTED IN SEPTEMBER, 1969.

P = pheasant

H = Hungarian partridge

ST = Sharp-tailed grouse

A = adult

J = juvenile

mercury P.P.M. = weight of mercury in wet weight of muscle tissue expressed in parts per million.

Analyses by the "neutron activation" method were done at the University of Toronto and by Gulf General Atomic, Inc., California.

Analyses by "atomic absorption" methods were done by Canada Department of Agriculture, Plant Products Division, Calgary, and by the Provincial Analyst.

TE	NO.	ECIES	SEX	AGE	WEIGHT	COLLECTOR	Q S T R W	DESCRIPTION	University Toronto	Cal. Gulf Atomic	Plant Products	Prov. Analyst
9-69	1	P	M	A	2 lb. 12 oz.	Bateman (Foremost)	SE- 15 - 7 - 12 - 4	Small hedge row Stubble field	0.050	0.006		NIL
"	2	P	M	J	2 lb. 12 oz.	Caldwell (High River)	4 mi. NE of Stavely		0.019 0.026			0.60
"	3	P	F	J	1 lb. 11 oz.	Caldwell (High River)	3 mi. NE of Claresholm		0.460 0.220			0.33
"	4	H	F	J	12 oz.	Wendland (Brooks)	SE - 2 - 19 - 14 -4					NIL
"	5	H	M	J	12 oz.	Wendland (Brooks)	SE - 2 - 19 - 14 -4					0.04
"	6	P	M	J	2 lb. 5 oz.	Caldwell (High River)	7 mi. NE Stavely					0.04
"	7	P	M	J	2 lb. 6 oz.	Caldwell (High River)	9 mi. SE Stavely			0.011		NIL
"	8	P	M	J	2 lb. 11½oz.	Caldwell (High River)	7 mi. NE Stavely					0.12
"	9	H	F	A	13 oz.	Bateman (Foremost)	NE - 8 - 2 - 15 -4	Small willow patches Strip Farm	0.019 0.049	0.035		NIL
"	10	P	F	J	7 oz.	Somerville (Lethbridge)	SE- 2 - 10 - 19 - 4	Alfalfa				Sample too Small
"	11	P	M	J	1 lb. 5 oz.	Caldwell (High River)	½ mi. W. Herronton		0.011			0.80
"	12	H	M	J	12 oz.	Bateman (Foremost)	SE- 4 - 4 - 15 - 4	Farming area				0.04
"	13	P	M	J	2 lb. 6½oz.	Caldwell (High River)	2 mi. E Blackie					NIL

DATE	BIRD NO.	SPECIES	SEX	AGE	WEIGHT	COLLECTOR	Q S T R W	DESCRIPTION	University Toronto	Cal. Gulf Atomic	Plant Products	Prov. Analyst
-9-69	14	H	M	J	13 oz.	Bateman (Foremost)	NE- 8 - 2 - 15 - 4	Strip farm, small Willow patches				0.04
"	15	H	M	A	12½oz.	Bateman (Foremost)	NE- 8 - 2 - 15 - 4	Farm site, stubble	0.027 0.075	0.812		NIL
"	16	H	M	J	13 oz.	Somerville (Lethbridge)	NW- 8 - 10- 15 - 5	Stubble		0.008		0.04
"	17	H	F	J	14 oz.	Bateman (Foremost)	Farming area near Verdigris Coulee					NIL
"	18	H	F	J	10 oz.	Bateman (Foremost)	NW- 15 - 6 - 12 -4	Flat stubble field		0.019		0.17
"	19	P	F	J	1 lb. 12 oz.	Caldwell (High River)	6 mi. SW Vulcan					NIL
"	20	H	F	A	12½oz.	Bateman (Foremost)	SE- 8 - 2 - 15 - 4	Strip farmed-small willow patches	0.032 0.021	0.033		NIL
"	21	H	M	A	13½oz.	Bateman (Foremost)	SE- 6 - 8 - 11 - 4	Stubble field near small hedge row	0.015 0.042	0.012		NIL
"	22	H	M	J	10 oz.	Barrett (Lethbridge)	SW- 25 - 6 - 21 -4	Irrigation and grain farming		0.004		Sample too Small
"	23	P	F	A	1 lb. 12 oz.	Bateman (Foremost)	SE- 4 - 4 - 15 - 4	Farmland stubble	0.034	0.029		NIL
"	24	P	M	A	2½lb.	Bateman (Foremost)	SW- 3 - 4 - 15 - 4	Farmland	0.052	0.015		0.04
"	25	P	F	A	2¼lb.	Bateman (Foremost)	SE- 9 - 3 - 15 - 4	Farmland crop adjacent to deep coulee	0.013	0.017		0.25
"	26	P	F	J	1 lb. 13 oz.	Caldwell (High River)	6 mi. SE High River					0.15

DATE	NO.	SPECIES	SEX	AGE	WEIGHT	COLLECTOR	Q S T R W	DESCRIPTION	University Toronto	Cal. Gulf Atomic	Plant Products	Prov. Analyst
20-9-69	27	P	M	A	2 lb. 9 oz.	Bateman (Foremost)	SW-21 - 6 - 11 - 4	Farmland adjacent to large coulee	0.031	0.014		0.02
"	28	P	M	J	2¼lb.	Wendland (Brooks)	NW-21 - 20 - 15 -4	Rosemary Area				NIL
"	29	H	F	J	8½oz.	Haugen (Lethbridge)	SE-25 - 11 - 20 -4	Grain				NIL
"	30	H	F	J	8½oz.	Haugen (Lethbridge)	SE-25 - 11 - 20 -4	Grain				Sample too Small
"	31	H	F	J	8½oz.	Haugen (Lethbridge)	SE-25 - 11 - 20 - 4	Grain				0.05
"	32	H	F	J	8½oz.	Haugen (Lethbridge)	SE-25 - 11 - 20 -4	Grain				Sample too Small
"	33	P	M	J	1 lb.	Wendland (Brooks)	NW-21 - 20 - 15 -4	Rosemary Area		0.017		0.04
"	34	P	F	?	1 lb.	Barrett (Lethbridge)	SE-25 - 11 - 24 - 4	Grain Area				0.15
"	35	P	?	J	½ lb.	Caldwell (High River)	6 mi. SW Vulcan					Sample too Small
"	36	H	F	J	7 oz.	Caldwell (High River)	12 mi. SW Kircaldy		0.024 0.057	0.006		Sample too Small
"	37	P	F	J	1 lb.	Barrett (Lethbridge)	S - 1 - 11 - 24 -4	Grain land, some pasture	0.043			NIL
"	38	P	M	J	1 lb. 7 oz.	Caldwell (High River)	11 mi. S High River					NIL
"	39	P	M	J	2¼lb.	Haugen (Lethbridge	S - 1 - 11 - 24-4	Grain and some pasture		0.010		0.04

DATE	NO.	SPECIES	SEX	AGE	WEIGHT	COLLECTOR	Q S T R W	DESCRIPTION	University Toronto	Cal. Gulf Atomic	Plant Products	Prov. Analyst
-9-69	40	P	F	J	1 lb. 6 oz.	Caldwell (High River)	4 mi. S Vulcan			0.013		NIL
"	41	P	F	J	1½lb.	Haugen (Lethbridge)	S - 30 - 4 - 20 -4	Mainly pasture, some grain				0.12
"	42	P	F	A	1 lb. 12 oz.	Caldwell (High River)	6 mi. SE Nanton		0.028	0.027		NIL
"	43	P	F	A	1 lb. 13 oz.	Haugen (High River)	SW- 18 - 14 - 19 -4	Grain	0.028 0.043 0.039	0.106		0.36
"	44	P	F	J	2 lb.	Barrett (Lethbridge)	SE- 5 - 6 - 21 - 4	Grain & pasture	0.004			0.33
"	45	P	M	J	12 oz.	Barrett (Lethbridge)	- - 11- 24 - 4	Grain land		0.040		Sample too Small
"	46	P	F	A	2 lb. 2 oz.	Somerville (Lethbridge)	NW- 27- 10 - 18 - 4	Pasture		0.038		NIL
"	47	P	M	J	2 lb.	Bateman (Foremost)	SE- 9 - 1 - 12 - 4	Farm stubble and brush		0.003		0.05
"	48	P	M	J	2 lb. 11oz.	Sole (Cardston)	- 24 - 6 - 22 -4	Grain fields along side of road of Magrath	0.021	0.014		0.17
"	49	P	M	J	2 lb. 12 oz.	Somerville (Lethbridge)	NW- 21 - 9 - 19 -4	Stubble				0.25
"	50	P	F	J	1 lb. 13½oz.	Barrett (Lethbridge)	SE- 5 - 6 - 21 - 4	Grain and pasture	0.006			0.32
"	51	P	F	J	2 lb.	Somerville (Lethbridge)	NW- 36 - 9 - 19 -4	Stubble	0.060			0.23
"	52	P	F	J	1 lb.	Sole (Cardston)	SE- 15 - 5 - 22 -4	Grain field along side of road				0.10

DATE	BIRD NO.	SPECIES	SEX	AGE	WEIGHT	COLLECTOR	Q S T R W	DESCRIPTION	MERCURY University Toronto	Cal. Gulf Atomic	Plant Products	Prov. Analyst
-9-69	53	P	F	J	2 lb. 14 oz.	Sole (Cardston)	SE- 15- 5- 22- 4	Grain fields along side of road				0.12
"	54	P	F	J	1 lb. 15 oz.	Sole (Cardston)	- 29- 6- 21- 4	Grain fields N of Magrath				0.10
"	55	P	F	J	1 lb. 10 oz.	Wendland (Brooks)	SE- 11- 16- 16- 4	Rainier Area				0.07
"	56	P	F	J	1 lb. 2½ oz.	Caldwell (High River)	7 mi. NE Stavely					0.17
"	57	P	F	J	14 oz.	Haugen (Lethbridge)	SW- 31- 12- 18- 4	Dryland Grain				0.15
"	58	H	M	J	1½ lb.	Haugen (Lethbridge)	NW- 18- 12- 19- 4	Grain				0.04
"	59	H	M	J	9½ oz.	Caldwell (High River)	5 mi. NW Ensign			0.018		0.08
"	60	P	F	J	1 lb. 14 oz.	Bateman (Foremost)	NW- 13- 1- 10- 4	Stubble field				0.04
"	61	P	M	J	2 lb. 11 oz.	Wendland (Brooks)	SW- 19- 15- 16- 4	Rainier Area	0.029			0.04
"	62	P	M	J	1 lb. 6½ oz.	Wendland (Brooks)	NW- 24- 16- 16- 4	Rainier Area				0.04
"	63	P	F	A	1 lb. 12 oz.	Wendland (Brooks)	NE- 31- 15- 15- 4	Scandia Area		0.105		0.04
"	64	P	F	J	1 lb. 3 oz.	Wendland (Brooks)	NW- 24- 16- 16- 4	Rainier Area				0.06
"	65	P	F	J	1¼ lb.	Haugen (Lethbridge)	NE- 12- 11- 30- 4	Grain Farming		0.014		0.03

DATE	NO.	CIES	SEX	AGE	WEIGHT	COLLECTOR	Q - S - T - W	DESCRIPTION	Toronto	Atomic	Products	Prov. Analyst
-9-69	66	P	M	J	2½lb.	Sole (Cardston)	SW- 5 - 5 - 23 - 4	Grain field on the edge of bushy growth to banks of St. Mary River.				0.02
"	67	P	M	J	2¼lb.	Somerville (Lethbridge)	SW- 3 - 10 - 19 - 4	Stubble				0.22
"	68	P	M	J	2½lb.	Somerville (Lethbridge)	SW- 3 - 10 - 19 - 4	Stubble		0.028		NIL
"	69	P	F	J	14 oz.	Wendland (Brooks)	NW- 24- 16- 16- 4	Rainier Area				0.04
"	70	H	M	J	11 oz.	Somerville (Lethbridge	NW- 36- 9 - 16- 4	Gravel road beside summerfallow				0.02
"	71	P	F	A	1 lb. 15 oz.	Barrett (Lethbridge)	NW- 34- 11- 24- 4	Grain land		0.044		0.02
"	72	P	M	J	2 lb. 3 oz.	Wendland (Brooks)	NE- 32- 13- 19 - 4	Patricia				0.03
"	73	H	F	J	13 oz.	Haugen (Lethbridge)	SW- 31- 12- 18 - 4	Dry land, grain		0.007		0.04
"	74	P	M	J	2 lb. 6 oz.	Barrett (Lethbridge)	SW- 24- 11- 24 - 4	Grain land				0.02
"	75	H	M	J	13 oz.	Barrett (Lethbridge)	NE- 36- 4 - 21 - 4	Pasture & some grain (fresh seeded winter wheat)				0.04
"	76	H	M	J	12 oz.	Wendland (Brooks)	SE- 2 - 19- 14 - 4	Brooks area		0.009		NIL
"	77	H	M	J	13 oz.	Wendland (Brooks)	SE- 2 - 19- 14 - 4					NIL

DATE	NO.	SPECIES	SEX	AGE	WEIGHT	COLLECTOR	Q S T R W	DESCRIPTION	University Toronto	Cal. Gulf Atomic	Int Products	Prov. Analyst
20-9-69	78	P	M	J	2 lb. 1 oz.	Wendland (Brooks)	SW- 25- 16- 15 - 4	Scandia Area		0.006		NIL
"	79	P	M	J	1 lb. 13 oz.	Sole (Cardston)	- 29- 6- 21 - 4	Grain fields				0.01
"	80	P	M	J	2 lb. 12 oz.	Bateman (Foremost)	NW- 22- 2- 14 - 4	Stubble adjacent to coulee		0.011		0.10
"	81	P	F	J	1 lb. 10 oz.	Wendland (Brooks)	NW- 21- 20- 15 - 4	Rosemary Area				0.02
4-9-69	82	Hun	F	J	12 oz.	D W (Pincher Creek)	NW- 32- 6- 29 - 4	Grain field bordering coulee & grassland		0.017		NIL
"	83	Hun	F	J	12 oz.	D W (Pincher Creek)	NW- 32- 6- 29 - 4	Grain field bordering coulee & grassland		0.017		NIL
"	84	Hun	F	A	13 oz.		SW- 1- 6- 27 - 4	Old farmstead bordering grain & hay field		0.035		NIL
"	85	Hun	F	A	13 oz.		SE- 21- 7- 29 - 4	Row of trees near grain & hay field		0.007		0.02
"	86	Hun	F	J	13 oz.	W W (Pincher Creek)	4 mi. N of Burdett	Carragana Bush				NIL
"	87	Hun	M	J	14 oz.	Pelchat (Brooks)	SW- 6- 17 -13 - 4					0.07
"	88	Hun	M	J	10 oz.	Pelchat (Brooks)	SW- 6- 17- 13 - 4		0.027			NIL
"	89	Hun	M	J	11 oz.	Pelchat (Brooks)	SW- 6- 17- 13 - 4		0.025	0.007		NIL

DATE	NO.	SPECIES	SEX	AGE	WEIGHT	COLLECTOR	Q S T R W	DESCRIPTION	University Toronto	Cal. Gulf Atomic	P... Products	Prov. Analyst
-9-69	114	STG	F	A	1 lb. 10 oz.	R.G.Hanson (Stettler)	SE- 22- 38- 19 - 4				0.21	
"	119	STG	F	A	1 lb. 11 oz.	Donaldson (Provost)	SE- 29- 44- 6 - 4				0.16	
"	120	Hun	F	J	9 oz.	Donaldson (Provost)	SE- 29- 44- 6 - 4					0.10
"	121	STG	F	J	1 lb. 6 oz.	Donaldson (Provost)	SE- 30- 44- 26- 4				0.13	
"	122	STG	M	A	1 lb. 14 oz.	Morton (Provost)	- 24- 38- 2- 4				0.10	
"	124	STG	F	A	1 lb. 8 oz.	Golka (Provost)	- 1- 42- 10 - 4				0.15	
"	128	STG	M	J	1 lb. 13 oz.	Moroz (Provost)	- 18- 36- 4 - 4				0.15	
"	134	P	M	J	2 lb. 14 oz.	Wileman (Red Deer)	SE- 12- 37- 3 - 5				0.15	0.08
"	140	P	M	J	2 lb. 12 oz.	Larson (Camrose)	NE- 18- 45- 19- 4				0.11	0.22
"	150	STG	F	A	1 lb. 11 oz.	Weisser (Rocky Mtn. House)	- 12- 27- 4 - 5					0.07
10-69	157	STG	F	J	1 lb. 9 oz.	Ramstead (High Prairie)	NW- 35- 74- 20- 5	Lot 22				
0-69	171	P	M	J	43 oz.	Wm. Day (Olds)	NE- 1- 30- 2 - 5	Lot 23				0.04

DATE	NO.	SPECIES	SEX	AGE	WEIGHT	COLLECTOR	Q S T R W	DESCRIPTION	University Toronto	Cal. Gulf Atomic	Plant Products	Prov. Analyst
24-9-69	90	Pheas	M	A	2 lb. 13 oz.	Pelchat (Brooks)	NE- 20- 17- 13 - 4			0.041		NIL
"	91	Hun	F	J	9 oz.	Pelchat (Brooks)	SW- 6- 17- 13 - 4					NIL
"	92	Pheas	M	A	3 lb.	J W	5 mi. N of Grassy Lake					NIL
"	100	Hun	M	A	13 oz.		SW- 1- 6- 27 - 4	Old farmstead bordering grain & hay		0.029		
"	103	STG	F	J	1 lb. 9 oz.		SW- 13- 6- 29 - 4	Grain field bordering road, rail		0.009		
"	104	STG	F	J	1 lb.		SE- 21- 7- 29 - 4	Trees bordering hay and grain field		0.007		
"	105	STG	F	A	1 lb. 10 oz.		SE- 21- 7- 29 - 4	Row of trees bordering grain & hay		0.013		
"	106	STG	M	A	1 lb. 15 oz.		SW- 7- 7- 29 - 4	Grain field, grassland coulee		0.005		
-9-69	110	P	M	J	2 lb. 14 oz.	R.G.Hanson (Stettler)	- 35- 41- 19 - 4				0.12	0.02
"	111	P	M	A	3 lb.	R.G.Hanson (Stettler)	NW- 21- 41- 18 - 4				0.14	0.04
"	112	STG	M	J	1 lb. 10 oz.	R.G.Hanson (Stettler)	SE- 20- 38- 20- 4				0.18	
"	113	STG	F	A	1 lb. 10 oz.	R.G.Hanson (Stettler)	NW- 14- 38- 19 - 4				0.12	

Date	No.	Species	Sex	Age	Weight	Collector	Q S T R W	Description				Mercury
2-10-69	174	P	M	J	45 oz.	Wm. Day (Olds)	NW- 6- 30- 1 - 5	Lot 23				0.02
"	175	P	M	J	47 oz.	M. Soder (Edmonton)	5 mi. W, 1 mi. N Villeneuve	Lot 24 - Possible Game Farm Bird				0.03
"	186	P	F	J	29 oz.	R.W.Sturm (Strathmore)	NW- 11- 23- 26- 4	Lot 25				0.09
"	195	P	M	A	46 oz.	R.W.Sturm (Strathmore)	SW- 25- 26- 25- 4	Lot 26				0.08
"	213	P	M	J	40 oz.	- (Medicine Hat)	1 mi. S, 1 mi. E of Seven Persons	Lot 28				0.02
"	226	P	M	A	43 oz.	Bateman (Medicine Hat)	NW- 17- 11- 7 - 4	Lot 29 (No liver sample)				0.05
"	250	P	M	J	40 oz.	G.Polluck (Drumheller-Hanna)	NE- 3- 27- 22- 4	Lot 32				0.09
"	257	P	F	J	28 oz.	G.Polluck (Drumheller-Hanna)	SE- 13- 27- 22 - 4	Lot 32				0.05
10-69	258	Hun	M	A	14 oz.	R.D.Hennig (Calgary)	NE- 16- 25- 3 - 5	Insufficient sample Discarded				
"	260	Hun	M	J	12 oz.	D.A.Glimsdale (Oyen)	SE- 26- 28- 1 - 4					0.09
"	278	P	M	J	48 oz.	G.Lee (Vegreville)	SW- 25- 51- 15- 4	Large gonads (Ad?)				0.03
"	279	Hun	F	J	12 oz.	P.Yaceyko (Vermilion)	NE- 26- 54- 7 - 4					0.09

DATE	NO.	SPECIES	SEX	AGE	WEIGHT	COLLECTOR	Q S T R W	DESCRIPTION		MERCURY		
6-10-69	289	Hun	M	A	14½oz.	G.Rowan (Cold Lake)	NW- 20- 63- 6 - 4					0.02
"	302	Hun	F	J	13 oz.	R.Harle (Bonnyville)	SE- 11- 61- 6 - 4					0.06
"	322	Hun	F	J	12 oz.	H.Schaber (Lac la Biche)	SW- 17- 65- 21 - 4					0.12
"	324	STG	M	J	29 oz.	H.Schaber (Athabasca)	SE- 35- 65- 23 - 4					0.09
"	328	Hun	M	J	12½oz.	N.Thomas (St. Paul)	NE- 36- 57- 10 - 4					0.07
4-10-69	348	Hun	M	J	12 oz.	(Evansburg)	4 mi. W of Evansburg, Hwy. 16					0.06
"	356	Hun	M	J	13 oz.	Allen & Clarke (Barrhead)	SW- 4 - 60 - 3 - 5					0.04
"	367	STG	M	J	1 lb. 11 oz.	Trepanier (Valleyview)	SE- 12- 75- 23 - 5					0.04
"	372	STG	M	J	1 lb. 10 oz.	(Grande Prairie)	NW- 30- 71- 3 - 6					0.08
"	377	STG	F	A	1 lb. 11 oz.	(Peace River)	SW- 3- 82- 22- 5					0.06

APPENDIX II

STATEMENTS OF THE A.I.C.P. REGARDING MERCURY RESIDUES IN GAME BIRDS

A. Statement for release to the news media, September 12, 1969.

B. Statement of the A.I.C.P. on the mercury problem in relation to upland game birds, December 17, 1969.

B. STATEMENT OF THE A.I.C.P. ON THE MERCURY PROBLEM IN RELATION TO UPLAND GAME BIRDS

In June and July 1969 all adult pheasants and Hungarian partridge collected in southern Alberta showed levels of mercury in their tissues above the 0.1 p.p.m. tolerance level established by the federal Food and Drug Directorate for food products. Nine laboratory analyses were carried out on 26 birds that were combined into 9 pooled samples of one to six birds each.

Only three out of 43 birds, however, collected in September and October and analyzed by the same laboratory showed above tolerance levels of mercury. In addition, 24 birds collected at the same time and analyzed by the same method by another laboratory showed only one bird with above the established level of mercury.

A total of 382 various game bird specimens have been collected across the Province and to date 92 have been analyzed for mercury. Investigations of those cases where birds were found with high levels of mercury in their tissues showed that some of these birds were feeding in areas where old stocks of mercury-treated seed had been dumped. Spillage of treated grain during handling, planting, treating and transporting is probably a major contributing factor in exposing game birds and other seed-eating wildlife to mercury.

Investigations are being conducted at present involving feeding experimental game birds to determine rates of accumulation and excretion of mercury. Game birds and other wildlife will also be collected periodically throughout 1970 for analyses of mercury and chlorinated hydrocarbon insecticides. A campaign is underway to inform growers on safe seed handling and disposal procedures. Also, sources of mercury contamination are being continually investigated by the Provincial Departments of Agriculture and Lands and Forests, and Canadian Wildlife Service.

Alberta Interdepartmental Committee on Pesticides

December 17, 1969

A. STATEMENT FOR RELEASE TO THE NEWS MEDIA

by

Hon. J. D. Ross, Minister
Department of Lands and Forests

1. D.D.T. and other organochlorine insecticides have not been found in significant quantities in upland game birds in Alberta. There is, therefore, no health hazard with regard to these chemicals in any of the upland game birds we have examined to date.

2. Total mercury levels in pheasants and Hungarian partridge examined were higher than the safe levels for human consumption established by the Food and Drug Directorate of the Department of National Health and Welfare. These levels refer to food produce sold commercially.

3. Because of high levels of mercury in pheasants and Hungarian partridge, the Alberta Interdepartmental Committee on Pesticides have recommended closure of the hunting season for 1969 on these two species. The recommendation was only made after full discussion by the Committee. High mercury levels in waterfowl and in species other than pheasants and Hungarian partridge, have not been found in investigation to date.

4. Closure of the hunting season was recommended as a public health safety measure. The closure will remain in effect until research data indicates that mercury residues have dropped to a safe level in pheasants and Hungarian partridge.

5. The agencies represented on the Alberta Interdepartmental Committee on Pesticides are now involved in all aspects of a full scale investigation of this problem. These agencies are Alberta Department of Agriculture, Canada Department of Agriculture, Alberta Department of Health, Canada Department of National Health and Welfare, Alberta Department of Lands and Forests, Canada Department of Indian Affairs and Northern Development and the University of Alberta.

6. The investigation of pesticide residues generally in wildlife has been going on for several years. The discovery of mercury at unsafe levels in wildlife in Alberta resulted from research carried out by the Canadian Wildlife Service.

September 12, 1969

APPENDIX III

MISCELLANEOUS MATERIAL RELATING TO THE MERCURY PROBLEM IN ALBERTA

Farm Notes: April 3, 1959; April 3, 1964; January 13, 1965; January 22, 1967; April 12, 1967; February 21, 1968; June 12, 1968; December 4, 1968; March 12, 1969; September 19, 1969;

Science and the Land, October 3, 1969.

Farm Notes
April 3, 1959

SAFETY WITH PESTICIDES

Greater use is now being made of herbicides, insecticides and other chemicals for the farm, garden and home. These pesticides are valuable aids in combatting weeds, insects and other pests. Most can also be extremely dangerous if not used properly, advises J. B. Gurba, Supervisor of Crop Protection and Pest Control, Alberta Department of Agriculture. Even the chemicals usually considered non-toxic can harm children or adults if inadvertently swallowed in sufficient amount.

Mr. S. McDonald of Science Service, Lethbridge, has compiled a list of human toxicity ratings for common pesticides. These are grouped into six classes varying from practically non-toxic to super toxic and the probable lethal dose in each group is outlined. Common chemicals such as 2,4-D, moth balls and kerosene fall into class 3, the moderately toxic group, while others such as strychnine, cyanide and parathion are listed in class 6 and are super toxic. Lethal doses vary from more than one quart to a taste.

This information is valuable in safeguarding human health and possibly life and may be obtained from all district agriculturists.

Farm Notes
April 3, 1964

SEED TREATMENT

One of the best investments made on the farm is the time and money spent on properly treating cereal and flax seed, says J. B. Gurba, Supervisor of Crop Protection and Pest Control with the Alberta Department of Agriculture.

Mr. Gurba reports that during five year field trials conducted several years ago by the Department of Agriculture, returns on treated seed amounted to an average increase of 3 bushels per acre. The cost of these extra 3 bushels per acre was approximately 5 cents per bushel of seed or 10 cents per acre.

Although disease and environmental conditions change every year, disease damage and loss are always sufficient to warrant seed treatment. This type of crop protection or insurance should be used every year since it is impossible to predict these conditions.

Mr. Gurba says proper seed treatment will control such diseases carried on the seed as covered smut on wheat, oats and barley and loose smut on oats. Special treatment is required for loose smut on wheat and barley. Because the fungus is hidden inside the seed it cannot be controlled by chemical treatment. Treatment of loose smut in wheat and barley is outlined in the publication "Seed Treatment for Field Crops", available from district agriculturists and the Extension Service of the Alberta Department of Agriculture.

Probably the most important benefit from seed treatment is the protection it provides for the seed and seedlings against fungi in the soil. These fungi cause seed rot, seedling blight, root rot, etc. They are especially bad for reducing germination and seedling growth under poor growing conditions.

Mercurials are best for treating cereal and flax, says Mr. Gurba. Non-mercurials can be used for bunt control in wheat and captan (orthocide) is approved for flax. Wireworms can be controlled with aldrin, heptachlor or lindane in specially formulated seed treatment compounds. Label directions should be followed closely for effective and safe treatment. Municipal seed cleaning plants are equipped to treat seed at low cost for disease and wireworm control.

Farm Notes
January 13, 1965

TREATED GRAIN VIOLATIONS

J. B. Gurba, Supervisor of Crop Protection and Pest Control with the Alberta Department of Agriculture, stresses that left-over treated grain must not be sold to elevators.

Mr. Gurba says that farmers and grain handlers should thoroughly clean out grain bins, truck boxes and augers to ensure that treated seed does not contaminate grain destined for human or animal consumption. Meat from animals which have eaten treated grain can contain harmful chemical residues.

Many Alberta farmers are horrified that the odd load of treated grain is still being delivered to elevators despite repeated warnings. The Board of Grain Commissioners report that over 300 grain cars, unloaded at terminal positions during the 1963-64 crop year, were found to contain some chemical residues from treated grain. Farmers themselves are advocating stiff penalties for anyone selling contaminated grain. Alberta Wheat Pool delegates passed a resolution at their annual meeting recommending a minimum fine of $250 for this offence.

Last fall several thousand bushels of grain were condemned by Board of Grain Commissioners' inspectors because one load of treated wheat was delivered to a local elevator. Investigations revealed the culprit and a charge was laid. The elevator agent lost his job for failing to detect the treated grain and the farmer was convicted of carelessness and fined accordingly. If civil action had been taken, he could have been liable for damages equal to the amount of grain condemned.

Cases like this should be a warning to farmers and elevator agents that treated grain must not be used or sold for human or animal consumption. Mr. Gurba says left-over treated seed should be properly stored and used the following season.

Farm Notes
January 22, 1967

DANGERS OF TREATED GRAIN

Mr. Joe Gurba of the Alberta Department of Agriculture, Plant Industry Division, says that some people are far too careless with treated grain. Due to the wet weather this spring, many farmers will find themselves faced with the problem of what to do with treated grain that couldn't be sown. Feeding treated grain is no solution. It is illegal as well as dangerous, because animals tend to concentrate the chemicals in their bodies. The only way to handle treated grain is to store it in a separate bin away from livestock and children, to be used for next year's seed.

Mr. Gurba also says that the Alberta Safety Council has instituted a new program to promote more careful handling of treated grain. The program has been endorsed by the Alberta Department of Agriculture, Alberta Co-op Seed Processors Ltd., Alberta Industrial Health Services Ltd., and the Workman's Compensation Board.

The major feature of the program will be the distribution of large posters to warn people of the dangers of treated grain. These will be posted in conspicuous places such as elevators and seed cleaning plants. Farmers and truckers will also be given smaller versions of the posters to be placed on trucks and posted in places where treated grain is stored. These will serve as a reminder of the dangers of treated grain as well as warning uninformed persons.

Farm Notes
April 12, 1967

AVOID RISKS BY TREATING YOUR SEED

Treat your seed this year to obtain maximum production at minimum cost.

J. B. Gurba, Supervisor of Crop Protection and Pest Control with the Alberta Plant Industry Division, reports that increased returns of about $4.00 per acre resulted when wheat was treated with mercurials during field trials conducted over a five year period. The cost of treatment was about 10¢ per acre.

Although disease and environmental conditions are different each year, losses from disease are always sifficient to warrant seed treatment. Proper seed treatment will control such diseases as covered smut in wheat, oats, and barley as well as loose smut in oats. Perhaps the most important benefit from seed treatment is the protection it provides against fungi in the soil. These fungi cause seed rot, seedling blight, root rot, etc. Fungi are particularly detrimental to seed germination and seedling growth under poor growing conditions.

Mr. Gurba strongly recommends treating all cereal and flax seed each year with a recommended fungicide. Although mercurials are generally used, captan also can be used to treat flax.

In fields where wireworms are a problem, effective control can be obtained with a recommended insecticide seed treatment at a cost of about 20¢ per acre. One treatment is usually sufficient to keep losses to a minimum for several years. Flax, rape, mustard, and legumes are seldom affected by wireworm damage. Cereals grown on fallow or grass-sod breaking are usually the most susceptible. To check the amount of damage that is being done in a field, Mr. Gurba suggests using a drill-box woreworm treatment on seed to be sown in part of the field and leaving the rest of the seed untreated.

In cases where flea beetles have been a problem on rape or mustard, special seed treatment powders containing lindane will give the seedlings good protection for about two weeks. This period is long enough to get them through the crucial stage.

Mr. Gurba warns anyone treating grain to guard against the hazards that can arise from the careless use of seed treatment compounds and from treated seed. He urges farmers to apply the chemicals properly, to use respirators and protective clothing, to store the chemical compounds and the treated seed safely, and to use common sense and good management practices.

Farm Notes
February 21, 1968

WHAT IS NEW IN SEED TREATMENT

All mercury seed treatment products accepted for registration or renewal under the terms of the Pest Control Products Act in 1968 must contain a heavy red dye which is fluorescent under an ultra violet light.

The purpose of this new regulation says J. B. Gurba, head of Alberta's Pest Control and Crop Protection Branch, is to make the detection of treated seed in elevators, feed mills, etc., easier and quicker. It will also make the work of the food products inspectors easier. At the present time trace residues in food are detectible by other methods, but the work involved is considerably more time consuming than will be the case under the new regulation.

A group of compounds which contain no mercury are now being tested for treating cereal and flax seed. If they measure up to company claims, they will control all the diseases in these crops that are now being controlled by the mercurials with less hazard to the person applying them, and a less serious residue problem in left-over treated seed. Although the mercury compounds have done a very good job in protecting cereal grains and flax from disease in the past, there is a definite trend towards the development of safer products.

Mr. Gurba points out that research has shown that left-over treated seed can now be stored for up to one year without any harm to germination, or a reduction in the effectiveness of the treatment, providing that the seed was dry when treated and that it is kept dry during the storage period.

The relatively new drill-box seed treatment that is available to farmers today virtually eliminates the need to carry over treated seed from one year to another. These products are powders which are mixed with the seed in the drill-box. This type of treatment, says Mr. Gurba, is practical for the small farmer and for the last stages of seeding on the big farm.

Farm Notes
June 12, 1968

DON'T FEED TREATED SEED

Is there a safe feeding level for treated grain and if so what is it?

The answer is definitely no, says the head of Alberta's crop protection and pest control branch, J. B. Gurba. He points out that at the recommended rate of application, treated cereal seed carries 20 to 30 parts per million of mercury or 500 to 900 parts per million of a chlorinated hydrocarbon wireworm control insecticide. Pesticides from both groups of chemicals are illegal in dairy products, meat or eggs.

These figures mean that it takes only one kernel of seed treated with a mercurial fungicide to contaminate 400 clean kernels, and only one kernel treated with a wireworm insecticide such as aldrin, heptachlor or lindane to contaminate 10,000 clean kernels. Although the mercurials are less potent than the wireworm insecticides, seed treated with them still poses a serious threat because of the far greater volume of mercurial treated seed.

Mr. Gurba feels that most of the contamination problems that appear from time to time do not arise from a deliberate flaunting of the law, but because people do not realize the small amount of treated seed required to contaminate thousands of bushels of clean grain. He stresses that a farmer cannot be too careful about preventing treated seed from spilling onto the ground and in cleaning his equipment and storage facilities. It is not enough, he says, to clean out a grain bin or truck box with a shovel; all the corners and crevices should be thoroughly swept out and grain augers should be properly cleaned after having been used for treated seed.

Both the federal and provincial departments of agriculture and the Food and Drug Directorate are constantly checking human food and animal feed on the market for signs of chemical residues. If any are found in eggs, milk or meat, the produce is traced back to its source, and the farmer concerned is forbidden to market the product until the problem has been cleared up. Since it can sometimes take several months to eliminate the source of the trouble, the ensuing loss of revenue is no small matter. In other words, the small saving from feeding a few bushels of contaminated feed just is not worth the risk of the much greater income loss that could follow, to say nothing of the human health hazard.

What should be done with left-over treated seed? Obviously planting it or storing it in a safe place until next year is the only sensible thing to do. Mr. Gurba says that a storage period of one year will not adversely affect the germination, providing the seed was dry when treated and is kept dry while in storage.

Farm Notes
December 4, 1968

PLANT PATHOLOGISTS DISCUSS SEED TREATMENT

A group of Alberta plant pathologists have expressed the view that treating seed in this province with fungicides at recommended rates is good farming practice. Recognizing the poison hazard involved in the use of many of the chemicals now available, the group stressed that farmers should use them carefully and in a responsible manner.

The Alberta plant pathologists and their federal counterparts working in Alberta were holding their annual meeting at the Lethbridge Research Station. They discussed a number of topics including seed treatment.

During a review of seed treatment recommendations for this province, it was pointed out that most of the varieties of spring and winter wheat, oats and barley recommended for use in Alberta are susceptible to surface-borne smuts. These and other seed-borne diseases can be effectively controlled by appropriate seed treatment chemicals.

Alberta leads the other prairie provinces in the percentage of seed that is treated with fungicides. One possible reason for this situation is that most of the 62 co-operatively owned seed cleaning plants located throughout the province offer farmers the opportunity to have their seed custom treated at the same time as it is being cleaned.

Despite the general use of seed treatment chemicals by Alberta grain producers, there is still too much untreated winter wheat being sown. Dr. G. T. Atkinson, cereal grain disease specialist at the Lethbridge Research Station, noted that 12 carloads of Alberta winter wheat were graded smutty by government inspectors during the 1967-68 crop year. In view of the relatively small volume of winter wheat grown in this province, 12 carloads represents a substantial proportion of the total.

Members of the group meeting at Lethbridge expressed concern that farmers may have difficulty in obtaining good quality seed for next spring because of the poor quality of much of this year's crop. Farmers who have to use shrunken or disease-infested seed would be well advised to treat such seed before sowing it. It is under such conditions as these that seed treatment provides a measure of assurance that a vigorous crop stand will be established. It is particularly true if growing conditions are unfavorable when the seed is sown.

Lloyd Peterson, pest control specialist with the Alberta Department of Agriculture, expressed concern about the continuing problem of treated seed getting into commercial feed and grain channels. He emphasized the need for Alberta farmers to recognize their responsibility by seeing that this does not happen. It is, he stated, a criminal offence to sell treated grain for anything other than seed.

Farm Notes
March 12, 1969

AN IMPORTANT REMINDER

Don't take a load of grain to the seed cleaning plant if you have just brought a load of treated seed home without thoroughly cleaning out your truck box, advises Dr. H. Vaartnou plant pathologist with the Alberta Crop Protection and Pest Control Branch.

This precaution is necessary to prevent treated seed from getting mixed with the screenings which will subsequently be used for livestock feed. The same precaution applies to grain that is hauled to the elevator in the same truck box that was used for hauling treated seed.

Remember, says Dr. Vaartnou, it is a serious criminal offence to deliver grain to an elevator that contains even one kernel of treated seed or to sell treated grain for any purpose other than for seed. The maximum fine for such an offence is $1,000!

Farm Notes
September 19, 1969

INVESTIGATIONS CONTINUE INTO CHEMICAL RESIDUE PROBLEM

Disclosure last week in Edmonton that certain upland game girds contain an abnormally high level of mercuric compounds in their bodies has caused consternation in wild life circles, and forced the Alberta government to consider cancelling the open hunting season on these birds this fall.

Although the exact source of contamination has not yet been established, it has been suggested that it has resulted from the birds having eaten grain treated with mercuric fungicides. This situation further strengthens the arguments of those who advocate tighter regulations for agricultural chemicals.

Gordon Kerr, biologist with the Wild Life Division of the Department of Lands and Forests, reports that mercury levels in pheasants and Hungarian partridges have been found to be three to eight times those authorized by the federal Health and Welfare Department. A commercial product with these same levels would be immediately removed from the market.

Because of these findings the joint committee on pesticides, composed of representatives from both federal and provincial Departments of Agriculture, Health, and Lands and Forests, recommended that the hunting season on pheasants and Hungarian partridges remain closed in Alberta this year.

When asked why other provinces do not seem to have the same problem, Mr. Kerr replied that their problem may not be as acute as ours, but the main factor is that Alberta has taken the lead in tracking it down. Other areas will probably intensify their investigations and find that they are in a similar situation.

At present the Department of Lands and Forests is testing more birds from the areas where the contamination was found last spring and summer to establish current mercury levels. If the source of contamination is found and eliminated, the present situation should be cleared up fairly quickly. Although little is known about the rate of loss of mercury in birds and animals, it is quite rapid compared with a chemical like DDT, and should be below levels that concern us within a year, says Mr. Kerr. Following this immediate testing program, the joint committee on pesticides hopes to set up a province-wide procedure on a year-round basis to check all types of chemicals.

Regarding animals and birds that prey on pheasants and partridges, Mr. Kerr believes the problem is even more serious. He reports that the levels of various types of chemicals that have been found in eagles, hawks, owls, etc., are thought to be the main reason for declining populations in these birds.

ISSUED UNDER DIRECTION OF MINISTER OF AGRICULTURE

SCIENCE AND THE LAND

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ALBERTA DEPARTMENT OF AGRICULTURE
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RESEARCH STATION, LETHBRIDGE
EXPERIMENTAL FARM, LACOMBE
EXPERIMENTAL FARM, BEAVERLODGE
EXPERIMENTAL FARM, MANYBERRIES
EXPERIMENTAL FARM, FORT VERMILION
ECONOMICS DIVISION, EDMONTON

Friday, October 3, 1969

FOR IMMEDIATE RELEASE

DIET OF ALBERTA GAME BIRDS

Recent widespread publicity over mercury contamination of a number of Alberta upland game birds has led to much interest and speculation about the diet and feeding habits of such birds. The answer to many of the questions being asked has been provided as the result of an eight-year study carried out by the late Dr. William Rowan and David Stelfox on game birds in central Alberta.

A zoologist at the University of Alberta, Dr. Rowan initiated the study in 1948 and carried it on until his death in 1956. Mr. Stelfox, currently supervisor of the Alberta department of agriculture crop clinic at Edmonton, and then a student working under Dr. Rowan, completed the study and compiled the data which is contained in a brief entitled "Upland Game Birds Food Habits Study."

From an examination of the crop and gizzard contents of more than 800 grouse, Hungarian partridge and pheasants that make up most of Alberta's upland game population, the two observers concluded that pheasants and Hungarian partridge use hard seeds and "stones" from wild fruits as grinding material when normal grits are not available. Compared to samples taken in the fall there was a marked decline in the amount of

(Continued)

Diet Of Alberta Game Birds (Continued):

grass and legumes consumed during January, February and March. During the same months there was a sharp rise in the intake of hard seeds and also an increase in the consumption of fleshy fruits.

As might be expected grains figured prominently in the diet of the birds. Oats, barley and wheat were found in 75, 60 and 30 per cent of the birds examined and this ratio probably indicated the predominance of coarse grains grown in Alberta's parkland. Rose hips and wild cherry fruits were utilized to a greater extent by the pheasant indicating this bird's feeding advantage over the partridge which must scratch for most of its feed during the winter.

In the spring grains continued to predominate feed samples but they were increasingly supplemented by leaves of grasses and legumes. Late fall samples indicated that barley, oats and wheat again comprised the bulk of the food intake. Next in dietary importance were the fruits of the snowberry, hemp nettle, wild cherry and rose.

Grits, reports Mr. Stelfox, were present in less than one-half the pheasant gizzard samples studied, and it is likely that certain types of hard seeds may have been used as a substitute grinding medium.

Hungarian partridges, unlike pheasants which frequently walk fenceline snow drifts while foraging for winter food, generally scratch through six to eight inches of snow. When snow becomes too deep or crusted the birds converge on livestock feedlots or the wind-swept perimeters of field granaries.

(Continued)

Diet Of Alberta Game Birds (Continued):

In the fall the traditional diet of lambsquarters, mustard and hemp nettle is supplemented by a heavy intake of waste grains including oats, barley and wheat, and by mid-December over 90 per cent of the diet is comprised of hard seeds.

The birds studied seemed to show a definite preference for oats over wheat and barley during the months of January to March. By the end of April cereal grains were still the principle plant food.

During the eight-year study the "huns" were frequently observed early mornings and late afternoons in winter picking up grits and spilled grain along the edges of snow-plowed rural roads. Fleshy fruits were seldom encountered in food samples examined and even though they were plentiful throughout the study area no rose pips were ever consumed. The birds may have recognized them as a fruit too large to swallow.

Considering the amount of weed seeds and insects it consumes the Hungarian partridge must undoubtedly be one of man's best friends, Mr. Stelfox believes.